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ETIOLOGY OF THE ILL-HEALTH OF CHILDREN BORN AFTER MATERNAL PELVIC IRRADIATION

PART I. UNHEALTHY CHILDREN BORN AFTER PRECONCEPTION PELVIC IRRADIATION

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THIS study represents part of an investigation undertaken by the Gynecean Hospital Institute of Gynecologic Research of the University of Pennsylvania, and deals with maternal therapeutic pelvic radium or roentgen irradiation and its effect upon the health and development of subsequent offspring. In the first report the literature dealing with the health of animal and human offspring born after ovarian or uterine irradiation of the mother was reviewed.[29] In a second communication the reports of several hundred human pregnancies associated with pelvic irradiation, secured by personal letters from the observers, were analyzed.[30] The literature dealing with the experimentally irradiated animal ovary was reviewed by one of us (Goldstein) in a recent publication.[26] For purposes of study the present contribution is divided into two parts, and deals with the actual pathological conditions affecting the unhealthy or abnormal children born after maternal pelvic irradiation.

Two of the previously mentioned studies[29,30] showed that maternal pelvic irradiation may be followed by the birth of unhealthy or defective children and that the irradiation may have been the cause of such ill-health or defect. In the present investigation all the *etiological* factors that may have been responsible for the production of the ill-health or abnormal condition of the children so studied were weighed in order to ascertain to what extent these factors influenced the health of the subjects, and in order to determine, if possible, the special rôle played by the irradiation in the production of the various disturbances.

In two of the previous papers[29,30] 625 pregnancies associated with ovarian and uterine irradiation were reported upon. The records of 76 *unhealthy* children born of these pregnancies, together with the reports of several other children recently reviewed in the literature, form the basis for this paper. Letters requesting additional information relative to these unhealthy children were sent to all known observers. Particular inquiry was made concerning the details of the maternal treatment, and regarding the health and development of the children from the time of birth to the present date. Information was also requested upon the following points: The maternal history prior to irradiation (i.e., number of pregnancies

and health of children); the ages of the irradiated women at the time of treatment, and the indications for which radiotherapy was instituted; the general health of the mothers prior to irradiation; the presence in the parents of alcoholism, syphilis, tuberculosis, or mental or nervous diseases; any complications of pregnancy or labor after irradiation; the condition of the children at the present time, and the outcome of any other pregnancies that may have occurred *after* the birth of the unhealthy children. This inquiry was made in order to secure data that might throw light on the etiology of the ill-health of such children. These additional data bring the total number of pregnancies associated with maternal irradiation studied to 650, and the number of unhealthy children (including stillbirths) resulting from these pregnancies to 84 (13 per cent).

In the previous studies it was observed that the percentage of developmental abnormalities among the children irradiated *in utero* was much greater than among the children whose mothers received pelvic radiotherapy *prior to conception*. In the former group of unhealthy children there was a high incidence (50 per cent) of serious lesions of the central nervous system and of other gross abnormalities. Few (12 per cent) serious gross deformities were observed in the group of unhealthy children born after preconception irradiation, whereas other less pronounced pathological conditions were more frequent. For purposes of study it was considered best to divide the children under discussion into two groups, according to the time of maternal treatment with respect to the date of conception, *since it appeared that the time of treatment was the most important determining factor in the production of disturbances of health in the offspring*. The group of unhealthy children born after preconception irradiation is discussed in this paper (Part I); the unhealthy children born of women who received radiotherapeutic treatment *during pregnancy* will be considered in Part II.*

Definition of "Unhealthy Child." Early in this investigation it was found necessary to arbitrarily define the term *unhealthy* as applied to children born after maternal pelvic irradiation. Any child who was stillborn, was born prematurely, or was born at term and exhibited any abnormality at birth, or who at any time after birth was affected with any disturbance of health or defect in development, or who, prior to the time of our inquiry, had died from any cause whatever, was considered to be *unhealthy*. This broad definition was deemed necessary so that the slightly subnormal or weak children would, for the purposes of this study, be classed as unhealthy.

* To be published in the October number of the Journal.

SUMMARY OF DATA

The entire number of pregnancies associated with maternal pelvic irradiation, the number of abortions, and the healthy and unhealthy children who resulted from these pregnancies, are recorded in Table 1. The 415 pregnancies (including two twin pregnancies) in women who were subjected to pelvic radiotherapy *prior to conception* resulted in the birth of 417 children (406 live births and 11 stillbirths). Forty-six of these children born of 38 women treated prior to conception were unhealthy. The factors underlying the causation of the ill-health or abnormal conditions in these 46 children are considered in the accompanying tables.

TABLE 1

OUTCOME OF PREGNANCIES ASSOCIATED WITH MATERNAL IRRADIATION

Data	No. of Pregnancies	No. of Healthy Children	No. of Unhealthy Children (Including Stillbirths)
Pregnancies ending in abortions	157	0	0
Pregnancies terminating at or near term of women receiving preconception irradiation	415*	371	46
Pregnancies terminating at or near term of women receiving postconception irradiation	75	37	38
Later pregnancies of women previously receiving postconception irradiation with birth of unhealthy children	3	3	0
Total	650 (100%)	411 (63%)	84 (13%)

* Including two twin pregnancies.

Showing the relative frequency with which abortions, healthy and unhealthy children resulted from pregnancies occurring in irradiated women. It is noted that 11 per cent of the 417 children born after preconception irradiation were unhealthy, whereas 51 per cent of the 75 children irradiated in utero were unhealthy.

TABLE II

CORRELATION OF MATERNAL ILL-HEALTH PRIOR TO IRRADIATION WITH THE ILL-HEALTH OF SUBSEQUENT CHILDREN

Case Number	Disturbance in Health	No. of Unhealthy Children	Description of Children	Reference
1	Anemia and heart defect	1	small at birth developed normally	2
2	General weakness	1	1st child normal 2nd child tuberculous 3rd child normal	18
3	General weakness and nervousness	1	stillborn with body rash	19 (a)
4	General weakness	2	1st premature, died in 2 weeks 2d child premature, stillborn	19 (b)
5	Hodgkin's disease	1	stillborn with malformed head	1 (a)

Showing the relation between maternal ill-health *prior to irradiation* and the health of the children born subsequent to irradiation, in 5 instances where data were available for study. In Case 1 only does there seem to be any possible relation between the state of maternal and ill-health health of the subsequent child.

FACTORS IN THE CAUSATION OF CHILD ILL-HEALTH EFFECTIVE PRIOR TO IRRADIATION

General Health of the Mother. It is commonly believed that certain diseases in the parents, particularly in the mother, may influence the health and development of the offspring. Syphilis, alcoholism, tuberculosis, and mental or nervous diseases in the parents may predispose the child to ill-health. A woman with inherent poor general health and weakness, although she may not be suffering from an organic disease, may, it is said, transmit this weakness to her children. Very little direct evidence has, however, been adduced to prove this contention. The general health of the irradiated woman was reported upon in 12 instances. In 7 it was noted as good and in 5 as poor. Reports as to the health of the father or other relatives were not available. Various health disturbances other than the pelvic diseases for which the irradiation was administered are presented in Table II. The influence of pelvic disease in the causation of child ill-health is discussed under "indications for treatment." It is believed that the condition of only one child (Case 1) may justifiably be attributed to maternal ill-health. It is doubtful whether the systemic ill-health in the remaining 4 women was connected with the ill-health of the subsequent children.

Age of Women at the Time of Irradiation. Most of the women were under thirty years of age at the time of treatment. A microcephalic child was born of a woman who was irradiated at the age of thirty-seven, but who had already given birth to two healthy children prior to treatment.[7] It is our belief that no importance can be attached to maternal age as a factor in the causation of the ill-health in the children under study.

Health of Children Born Prior to Irradiation. The physical condition of the children born *before* maternal irradiation was studied in order to ascertain if any relation between the health of these children and the health of the children born *after the irradiation* might be found to exist. The histories of 18 women prior to irradiation were available for examination. With the exception of 2 stillbirths and 10 abortions, no unhealthy children resulted from the 55 pregnancies occurring prior to the irradiation (Table III). The women whose pregnancies ended in stillbirths or abortions had also given birth to healthy children. The unhealthy children born

TABLE III

MATERNAL HISTORY OF 18 WOMEN PRIOR TO THE DATE OF IRRADIATION

Data	Number of Women	Number of Pregnancies or Children
No previous pregnancies	5	0
Previous pregnancies	13	55
a. Abortions	..	10
b. Stillbirths	..	2
c. Healthy children	..	43
d. Unhealthy children	..	0

Showing the outcome of 55 pregnancies occurring in 13 women who had one or more pregnancies *prior* to pelvic irradiation, and who also had at least one unhealthy child subsequent to such treatment. It is interesting to note that with the exception of 2 stillbirths, no abnormal or defective children were born of these mothers prior to irradiation.

subsequent to the administration of radiotherapy were the only unhealthy children born of these mothers. Five unhealthy children born after irradiation were the offspring of primiparae. No discernible relation could be found between the health of the children born *before irradiation* and the state of health of the children born after irradiation.

FACTORS IN THE CAUSATION OF THE CHILD ILL-HEALTH EFFECTIVE AFTER IRRADIATION

Complications of Pregnancy Followed by the Birth of Unhealthy Children. The health of the irradiated woman during the course of pregnancy was investigated especially to learn of the existence of any pathological condition that might have tended to impair the growth of the fetus. It is a generally recognized fact that if the mother does not enjoy good health during pregnancy, the nutrition of the fetus may be prejudicially affected and a small and weak child may be the result. The health of 17 women during pregnancy is recorded in Table IV. It will be noted that in 4 cases of eclampsia the women gave birth to 5 unhealthy (not deformed) children, including one pair of twins. It is extremely likely that the toxemia of pregnancy, rather than the irradiation, affected these children, since maternal toxemia frequently has injurious effects on the fetus.

TABLE IV

MATERNAL HEALTH DURING PREGNANCY

Number of maternal health reports	17
Normal pregnancies	13
Complicated pregnancies (eclampsia)	4
Unhealthy children resulting from abnormal pregnancies	5
1. Stillbirth	(Ref. 17)
2 and 3. Twins, died in 2 days	(Ref. 5)
4. Premature, died in 2 days	(Ref. 15a)
5. Anemic at birth	(Ref. 9)

Showing the nature of the health disturbances in 5 children whose mothers suffered from eclampsia during pregnancy.

Labor Complications Followed by the Birth of Unhealthy Children. Types of labor were reported upon in 11 women. In 5 cases the labors were reported as normal and spontaneous and in 6 as abnormal or complicated. The abnormalities of labor and the methods of delivery with the resulting health disturbances are shown in Table V. Six women had abnormal labors terminating in the birth of either stillborn children or children that died shortly after delivery. The abnormal labors, the methods of delivery, and the presence of other complications were most likely responsible for the pathological disturbances exhibited by the 6 resulting children. Pelvic diseases or complications rather than irradiation were the probable cause of the prolonged labor in these cases. In one instance, however, the stenosis of the cervix which necessitated delivery by craniotomy may have been due to the irradiation.[21]

Premature Labors Terminating in the Birth of Unhealthy Children. Table VI shows the number of unhealthy children born after premature labor in 6 women irradiated before conception took place. In one case the woman became pregnant twice after irradiation, both pregnancies terminating prematurely. Five immature children were either stillborn or died

TABLE V

CORRELATION OF ABNORMAL LABORS WITH RESULTING CHILD HEALTH DISTURBANCES

No. of women	Labor Complications	Method of Delivery	No. of Unhealthy Children	Condition of Children	Reference
1	Knotted cord	spontaneous	1	stillborn	6
2	Prolonged labor	instrumental	1	child died in 2 days (2d pregnancy)	11 (a)
3	Prolonged labor	instrumental	1	one of twins died shortly after birth	15 (b)
4	Unknown	Caesarian section	1	stillborn (2d pregnancy)	11 (b)
5	Prolonged labor	Caesarian section	1	died in few hours	13
6	Stenosis of cervix (from radium)	craniotomy	1	mutilated fetus	21

Showing the relation between the abnormal labors and the health of the resulting children in 6 cases in which data were available regarding this point. The 6 children born after abnormal labors were either stillborn or died shortly after delivery.

TABLE VI

ABNORMAL CHILDREN BORN AFTER PREMATURE LABOR

No. of Women	Method of Delivery	Condition of Children	References
1*a*	Spontaneous	1. premature, died in 2 weeks (first pregnancy)	19 (b)
1*b*	Spontaneous	2. premature, stillborn (second pregnancy)	
2	Spontaneous	3. premature, died in 8 hours (second pregnancy)	22 (a)
3	Spontaneous	4. premature, normal at 3 yrs.	10
4	Spontaneous	5. died in 3 weeks	19 (c)
5	Unknown	6. premature; developed normally	23
6	Unknown	7. premature, stillborn	19 (d)

Showing the relation between prematurity of birth and the subsequent health of 6 children, born of mothers receiving *preconception* pelvic irradiation. Note that 5 of the children were either stillborn or died shortly after birth, while 2 developed normally.

shortly after birth; 2 developed normally. The causes of the premature labors are unknown. A conceivable explanation, and one worthy of consideration is that in some manner the irradiation so affected the uterine mucosa or the ovum, which later became fertilized, that the growing fetus could not maintain its normal development until the end of gestation. It is believed, however, that the condition of the children born after the premature labors might justly be attributed to immaturity, rather than to any direct effect of the radioactive agents on the germ-plasm, since 2 of the children developed normally.

TABLE VII

ORDER OF BIRTHS OF THE UNHEALTHY AND HEALTHY CHILDREN BORN AFTER IRRADIATION TO THE MOTHERS OF UNHEALTHY CHILDREN

Order of Pregnancy	I Number of Unhealthy Children	II Number of Healthy Children
First pregnancy following irradiation	35	5
Second pregnancy following irradiation	11	3
Third pregnancy following irradiation	0	2
Fourth pregnancy following irradiation	0	1
	46	11

Showing the order of birth of 57 children both healthy and unhealthy, of women who gave birth to unhealthy children subsequent to pelvic irradiation. Note that 35 unhealthy children resulted from pregnancies immediately following the irradiation and 11 resulted from second pregnancies. The 46 women gave birth to 11 healthy children.

Order of Birth of Children Born after Irradiation. The unhealthy children have been classified according to the order of birth, for in a number of cases the first pregnancy after irradiation resulted in the birth of a healthy child, to be followed later by the birth of an unhealthy one. Table VII records the sequence of birth of the 11 healthy children who were born of the same mothers as these unhealthy infants. It will be observed that the third and fourth pregnancies reported after irradiation resulted in the birth of healthy children. Five healthy children the result of the first pregnancies after irradiation

TABLE VIII

ARRANGEMENT AS TO SEQUENCE OF BIRTH OF HEALTHY CHILDREN (FROM TABLE VII) AMONG UNHEALTHY ONES BORN AFTER IRRADIATION

No. of Women	Order of Birth: First Child	Second Child	Third Child	Fourth Child	Reference
1	healthy	†died in 2 days* (forceps delivery)	no report	.....	11 (a)
2	healthy	†stillbirth* (Caesarian section)	no report	.....	11 (b)
3	healthy	†died of tuberculosis at 10 mo.	healthy	none	18
4	healthy	†rachitic	no report	.....	22 (f)
5*a*	one of twins healthy	†stillborn (weighed 1½ lb.)	healthy	healthy	15 (b)
5*b*	*one died of forceps injury				
6	*stillborn (knotted cord)	healthy	none	.....	6
7	small at birth, developed normally	healthy	abortion	abortion	24
8	congenital heart defect	healthy	no report	.....	20

* Etiology of ill-health in these children has been previously indicated in Table v.

† The fact that these children followed healthy ones diminishes the likelihood of irradiation as a factor in the causation of the ill-health.

Showing the sequence of birth of the healthy and unhealthy children born after maternal pelvic irradiation.

TABLE IX

CASES OF TWO UNHEALTHY CHILDREN BORN OF IRRADIATED MOTHERS

No. of Women	First Child	Second Child	Third Child	References
1	*premature, died in 2 weeks	*premature, stillborn	none	19 (b)
2	at 12 years of age is overweight and does not learn readily	*premature, died in 8 hours	no report	22 (a)
3	died of rachitis	weak and frequently ill at 2 years	no report	22 (b)
4	tibiae crooked at birth, straight at 6 years	died of pleurisy at 11 months	no report	22 (c)
5	died of tuberculosis at 1½ years	died of pneumonia at 1½ years	no report	22 (d)
6	congenital tracheal stenosis	congenital cardiac defect	no report	22 (e)

* The cause of death in these children has been considered in Table VI.

Showing the number of women receiving pelvic irradiation who subsequently gave birth to 2 unhealthy children. It is noted that 10 of the *unhealthy* children reported, were observed by one physician.[22]

were followed by the birth of unhealthy children; these latter are included among the 11 unhealthy children resulting from second pregnancies.

The 11 normal children born of women who also gave birth to abnormal children after irradiation are listed in Table VIII. It will be seen that 5 *healthy* children, including a pair of twins (the first 5 cases in Table V), were followed by the birth of 5 *unhealthy* ones. Two of these 5 defective children (11a and 11b) who followed the healthy ones suffered as the result of abnormal labors (see Table V); the diseases affecting 2 other children (Nos. 18 and 22f) and the stillborn child (15b) may readily be explained as accidental occurrences. The fact that healthy children followed the birth of unhealthy ones lessens the likelihood of irradiation being the cause of the ill-health of these children.

It will also be noted from Table VIII that 3 unhealthy children were followed by the birth of 3 normal ones. One stillbirth preceded a normal child;[6] one child suffering from a heart defect was followed by the birth of a healthy child;[20] and one small child at birth, was followed by a normal one.[24]

In 6 instances *unhealthy* children were followed by unhealthy ones, and one premature stillborn child was followed by another premature birth (Table IX). It is interesting to note that of these 12 cases of child ill-health 10 were reported by one author.[22]

CHILD ILL-HEALTH AFTER PRECONCEPTION PELVIC ROENTGEN THERAPY

The various causes of child ill-health in children born after preconception pelvic irradiation have been discussed without regard to the type of such irradiation. The various disturbances manifested at birth and the later development of the children are now correlated with the types of maternal irradiation and the details of treatment.

Observations made upon 18 unhealthy children born after maternal pelvic *roentgen* therapy, the time elapsing between the last treatment and the date of delivery, the indications for roentgen therapy, and the outcome of still later pregnancies occurring in the irradiated women since the birth of the first unhealthy children are recorded in Table X. The 7 children in whom the causes for ill-health are known are indicated by a star (*) or dagger (†) in this table. In the remaining 11 children the etiology of the various disturbances of health or development could not be learned. In this group are included 2 children who suffered from congenital cardiac defects,[20,22] one child who presented a congenital tracheal derangement,[22] one child who exhibited a malformation of the head,[1] and one who was a microcephalic idiot.[7] The remaining children were affected by other diseases, infections, or debilitating conditions.

Details of Roentgen Therapy. Most of the observers recorded the amount of treatment and the technique employed. However the technique and the units of measurement varied widely. A few examples are cited to show the widely differing nature of the reports recorded: Schmitt[18]—One treatment; two abdominal fields and two sacral fields. Each field received 25 per cent of a skin erythema dose (S.E.D.), and each ovary received

TABLE X

DATA CONCERNING CHILDREN BORN AFTER PRECONCEPTION PELVIC ROENTGEN THERAPY

Case Number	Interval between Treatment Date and Date of Birth of Unhealthy Children	Indication for Radiotherapy	Condition of Children at Birth	Condition of Children at Last Observation	Other Pregnancies and Normal Children after Irradiation	References
1	1½ yrs.	metrorrhagia	*small at birth	developed normally	unknown	2
2	1 yr.	myxo-myoma	*healthy at birth	died of bronchitis in 1 wk.	unknown	8
3	unknown	menorrhagia	†1st child stillborn (knotted cord)	dead	2d normal	6
4	unknown	unknown	†stillborn (mother eclamptic)	dead	none	17
5	1 yr.	menorrhagia	†premature	normal at 3 yrs.	none	10
6	2 yrs.	menorrhagia	†2d child normal at birth	tuberculous, died at 10 mos.	1st child well at 4 yrs. 3d normal at 1 yr.	18
7a	unknown	menorrhagia	1st child unknown	overweight and learns poorly at 11 years	2 abortions	22
7b	unknown	.....	†2d child premature	died 8 hrs. after birth		
8a	unknown	menorrhagia	1st child unknown	died of tuberculosis at 1½ yrs.	2 abortions	22
8b	unknown	.....	2d child unknown	died of pneumonia at 1½ yrs.		
9	unknown	menorrhagia	unknown	subnormal in weight and height at 9 yrs.	unknown	22
10	2 yrs.	functional menorrhagia	weak, otherwise normal	rachitic and subject to infections at 3 yrs.	unknown	14
11	1 yr.	Hodgkin's disease	malformed head, brain exposed	died 11 hours after birth	unknown	1
12	2½ yrs.	myoma uteri	microcephalic mongol	idiotic at 5 yrs.	none	7
13	2 yrs.	functional metrorrhagia	apparently normal	poorly developed physically and mentally at 2 yrs.	none	16
14	1 yr.	oligomenorrhea	1st child, congenital heart defect	died 2 days after birth	2d child normal at 1 yr.	20
15a	unknown	menorrhagia	1st child, congenital tracheal stenosis	underweight at 8 yrs.	2 abortions	22
15b	unknown	.....	2d child, congenital heart defect	underweight at 5 yrs.		

* Condition of these children probably not influenced by irradiation.
† Etiology of ill-health in these children indicated on previous tables.
Presenting data concerning the treatment and descriptions of children born after preconception pelvic roentgen therapy. Note that the causative factors of the ill-health in the children of cases 7a, and 8a to 15 could not be determined.

18 per cent S.E.D. Rothschild[16]—One treatment; 50 per cent S.E.D., 0.75 mm. copper and 1 mm. of aluminum as filter, at 50 cm. distance, over both ovaries and uterus, exposure of 52 minutes. Gummert[7]—Castration dose, 17 cm. focal distance, 3 mm. aluminum filter, 20 exposures, each for 30 minutes. Hanks[8]—Dosage not estimated, four series of treatment, total of 60 exposures, at 7 inch focal distance, 5 mm. aluminum and 1 mm. leather filter, anterior and posterior fields of 2¼ inches each, exposures of 4 minutes to each area.

J. L. Weatherwax,[31] physicist to the Radiologic Department of the Philadelphia General Hospital, who examined the dosage records, found it impossible to correlate them according to any single standard of measurement. In most instances the menorrhagia or other menstrual disturbances for which the therapeutic irradiation was given was either relieved or entirely cured, and in a number of cases temporary amenorrhea was observed before the onset of pregnancy, showing that, in the majority of cases at least, a moderate dosage was administered. This effect on ovarian function was probably produced by the direct action of the radiation upon the ovarian structure.[26]

Time Elapsing between Last Treatment and Date of Child-birth. The time elapsing between the date of the last roentgen treatment and that of birth of the subsequent unhealthy children was stated in 9 instances. This interval varied from one year to two and a half years. In 4 cases the pregnancy began about three months after cessation of treatment, whereas only one seriously defective child was born as late as two and half years after roentgen irradiation.[7] The periods of time elapsing between the dates of treatment and the dates of delivery of the unhealthy children are shown in Figure 1.

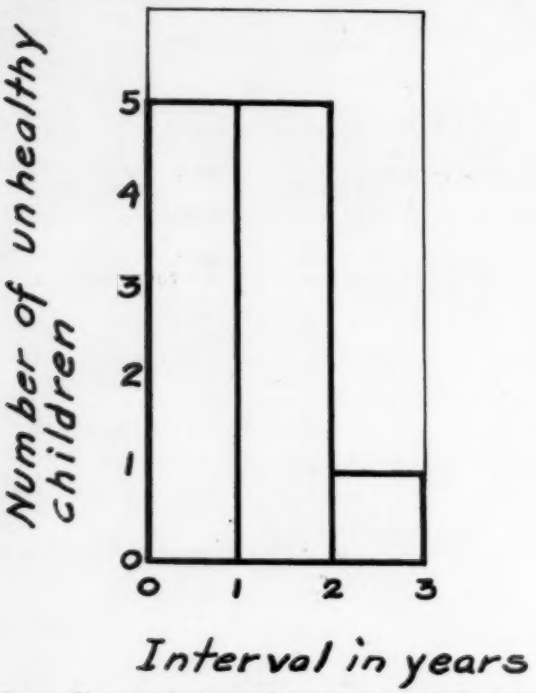

FIG. 1. Showing the intervals in years elapsing between the date of last roentgen treatment and date of delivery of 11 unhealthy children from Table X. Note that 10 of the children were born within two years of the treatment.

Indications for Treatment. Menorrhagia, probably of ovarian origin, was the most common indication for pelvic roentgen therapy. The significance of the rôle played by menstrual disorders and pelvic diseases in general in the causation of health disturbances in children is at present not understood.

Additional Pregnancies after Roentgen Irradiation. Reports of pregnancies other than those resulting in the birth of unhealthy children occurring after irradiation were obtained concerning 10 women. Four of these had no pregnancies after irradiation other than those resulting in the birth of the unhealthy children reported in this paper. In 3 women 2 abortions had occurred, and in 3 cases one or more healthy children in addition to the unhealthy ones were born.

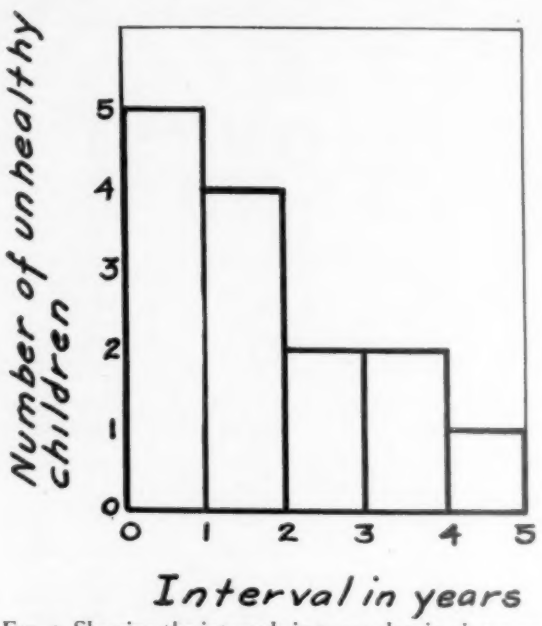

FIG. 2. Showing the intervals in years elapsing between the date of radium treatment and the date of delivery of 14 unhealthy children from Table XI. Note that the number of children becomes less as the time interval becomes longer. The 2 children born as late as four years after irradiation were twins.

CHILD ILL-HEALTH AFTER PRECONCEPTION INTRAUTERINE RADIUM THERAPY

Twenty-eight *unhealthy* children were born after intrauterine radium or mesothorium treatment. The details of the treatment, the indications for the same, a brief description of the children, and the outcome of other pregnancies occurring after irradiation are outlined in Table XI. From this table it will be seen that the probable cause of the ill-health has been determined in 17 children (indicated by a star * or dagger †), and is unknown in 11. Only 2 seriously defective children are included in this latter group; namely, a hydrocephalic mongol ,[12] and a stillborn anencephalic monster.[3] The other children

TABLE XI

DETAILS OF TREATMENT AND DESCRIPTION OF CHILDREN BORN AFTER PRECONCEPTION INTRAUTERINE RADIUM THERAPY

Case Number	Interval between Treatment Date and Date of Birth of Unhealthy Children	Dosage in Mg-hr.	Filter	Indication for Treatment			Condition of Children at Birth	Report of Last Observation	Other Pregnancies and Normal Children after Irradiation	References
				Menorrhagia	Metrorrhagia	Unknown				
1	4 yrs.	unknown	unknown	..	..	×	†weak (twins), mother eclamptic	died within 48 hrs.	none	5
2	1 yr.	900	5 mm. Ag, and rubber	×	..	..	†premature (mother eclamptic	died in 2 days	none	15
3	2 yrs.	525	unknown	..	..	×	†anemic at birth (mother eclamptic)	well at 7 mos.	none	9
4	unknown	150	1 mm. brass, 5 mm. Al	×	..	..	†2d child stillborn (Caesarian section)	dead	1st child normal	11
5	2¾ yrs.	400	1 mm. brass 5 mm. Al	×	..	..	†2d child weak, forceps delivery	died in 2 days	1st normal	11
6	2 yrs.	600	5 mm. Ag, rubber	×	..	..	†1st, twins, forceps delivery †2d child stillborn	one died in 2 days dead	one twin normal 3d child normal 4th child normal	15
7	unknown	unknown	unknown	..	..	×	†died few hrs. after delivery by Caesarian section	dead	none	13
8	1 yr.	1920	unknown	..	×	..	†mutilated fetus (craniotomy)	dead	unknown	21
9a	1¾ yrs.	300	1 mm. brass,	×	..	..	†1st child premature	died in 2 weeks	none	19
9b	unknown	300	and rubber	..	..	..	†2d child premature stillborn	dead		
10	1 yr.	250	1 mm. brass and rubber	×	..	..	†premature	died in 3 wks.	none	19
11	unknown	300	unknown	..	..	×	†premature	normally developed at 6 mos. of age	unknown	23
12	3 yrs.	230	1 mm. brass, and rubber	×	..	..	†premature, stillborn	dead	none	19
13	unknown	unknown	unknown	×	..	..	†2d, unknown	2d, rachitic	1st normal	22
14	5 yrs.	unknown (mesothorium)	gold and rubber	..	× Cancer	..	*small, otherwise normal	normally developed at 9 years	2d, normal, 3 abortions	24
15	1 yr.	300	1 mm. brass, and rubber	×	..	..	stillborn, with body rash	dead	none	19
16	unknown	300	1 mm. brass, 5 mm. Al	×	..	..	weak at birth	died in few hours	unknown	11
17	1¾ yrs.	unknown	unknown	..	..	×	stillborn	dead	unknown	1
18	agent and time unknown	unknown	unknown	..	..	×	stillborn (atelectatic)	dead	unknown	4
19	unknown	unknown	unknown	×	..	..	unknown	died of pneumonia at 1 yr.	unknown	22
20a	unknown	unknown	unknown	×	..	..	1st child, unknown	1st child died of rachitis at 9 mos.	unknown	22
20b	unknown	unknown	.....	..	..	..	2d child, unknown	2d child frequently ill at 2 yrs.		
21a	unknown	unknown	unknown	×	..	..	1st child, crooked tibiae	tibiae straight, child normal at 6 yrs.	unknown	22
21b	unknown	unknown	.....	..	..	..	2d child, unknown	2d child died of pleurisy at 11 mos.		
22	unknown	unknown	unknown	..	..	×	stillborn, anencephalic	dead	unknown	3
23	10 mos.	1800	2 mm. Pb	×	..	..	normal at birth	hydrocephalic mongol at 5 yrs.	3 abortions	12

† The etiology of the ill-health in these children has been indicated in the previous tables.
* Reports now indicate that this child is healthy.
Presenting the details of treatment of the mothers and descriptions of the children born after preconception pelvic intrauterine radium therapy. Note that the causative factors of the ill-health in the children from Nos. 15 to 23 could not be determined.

were stillborn, weak, or suffered from infectious diseases.

Time between Treatment and Date of Childbirth. The duration of time elapsed between the date of the radium treatment and that of the delivery of the unhealthy children is shown im Figure 2. Four children were born within one year from

the time of treatment. Three children, including one pair of twins, were born as late as four years after treatment,[5,24] and, as has previously been indicated in Tables IV and VIII, the irradiation apparently was not a factor in the causation of the ill-health of these children.

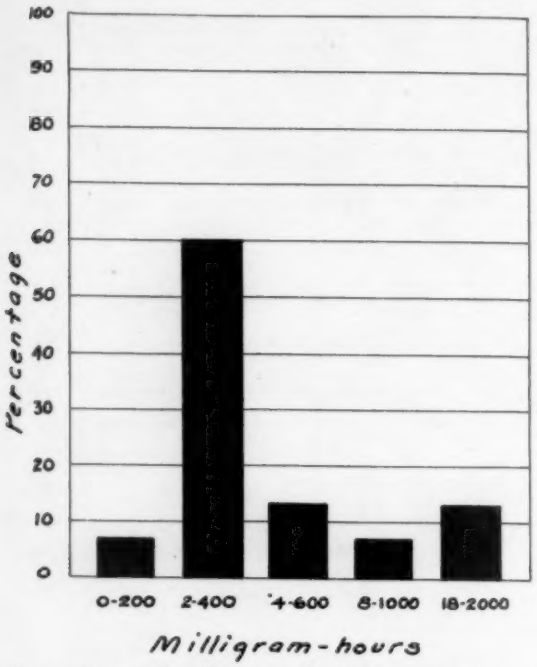

FIG. 3. Doses of radium employed in maternal treatment in 15 cases. Showing the percentages of unhealthy children arranged according to the various doses. Note that most of the children were born of mothers who received exposures of 2 to 400 mg-hr. of radium prior to conception.

Details of Radium Treatment. More exact information was obtained concerning the dosage of radium or mesothorium administered than regarding the dosage of roentgen rays. Figure 3 shows that the dosage most commonly employed was 660 mg-hr. or less. The exposures ranged from as low as 150 mg-hr. to as high as 1900 mg-hr. In one case in which an exposure of 1800 mg-hr. was given, the patient gave birth to a child within a year of the treatment; this was described at the age of five years as a hydrocephalic mongol.[12] This is the only instance known to the writers in which so large a radium exposure before conception was followed by the birth of a seriously defective child. None of the children born of the women receiving exposures as low as 600 mg-hr. or less suffered any serious defects that could not be explained on grounds other than the irradiation.

Indications for Treatment. The most common indication for radium therapy was menorrhagia, probably due to ovarian dysfunction. The next most common indication was metrorrhagia; in the remaining cases the indication was unknown.

Additional Pregnancies after Irradiation. Fourteen reports concerning additional pregnancies in the women giving birth to unhealthy children after irradiation were obtained. Of these women 8 did not become pregnant subsequently. One woman had 3 abortions following the birth of a hydrocephalic mongol.[12] Five women bore normal children besides those which were unhealthy.

DISCUSSION OF THE ETIOLOGY OF CHILD ILL-HEALTH AFTER IRRADIATION

The etiology concerned in the production of the ill-health in the children born after *preconception* pelvic irradiation has been thoroughly investigated. In Table XII the unhealthy children have been classified according to the general nature of the disturbances, and as to whether or not the causes of these disturbances are known. This classification was made after careful weighing and consideration of the various influences acting upon mother and child. It is believed that in 24 of the children born after preconception irradiation the ill-health has properly been attributed to the factors indicated in the first part of this paper. Of the entire group of 417 children born after such treatment who suffered ill-health concerning the etiology of which very little or nothing is known, there remain only 22 (5 per cent). Fifteen of these children suffered from infectious diseases and other disturbances of varying severity. In these cases the etiology could not be determined because of the lack of information concerning the maternal or other influences. Apparently, however, no damage had been done to the germ-plasm in these cases, since no anatomic defects were observed in these children. The remaining 7 children exhibited serious developmental disturbances. This group

TABLE XII

GROUPING OF UNHEALTHY CHILDREN ACCORDING TO TYPE OF DEFECT

Condition of Children	Causes of Defect Known	Causes of Defect Unknown	Total
Premature, weak or diseased	17	12	29
Stillborn (including one malformed)	7	4	11*
Deformed (live births)	0	6	6
Total	24	22	46

* Two stillbirths are included here although the treatment was not definitely known to be preconception in time.

Presents the unhealthy children according to the type of disturbances observed. Note the large number of premature, weak or diseased children as compared with the small number of deformed and stillborn children.

TABLE XIII

INFANT MORTALITY RATE FOR THE UNITED STATES IN 1921, AND THE ESTIMATED MORTALITY RATE FOR INFANTS OF MOTHERS RECEIVING PRECONCEPTION IRRADIATION, BY CAUSE OF DEATH

Cause of Death	Children after Preconception Irradiation		United States Birth-Registration Area as of 1915. Mortality Rate for 1921
	Number of Deaths	Mortality Rate	
All causes	20	49.2	78.67
Gastrointestinal diseases	0	0	16.08
Respiratory diseases	4	9.8	11.23
Malformations	2	4.9	7.08
Early infancy	13	32.0	30.63
Communicable diseases	0	0	5.07
External causes	0	0	0.80
All other causes	1	2.5	6.87

Showing the infant mortality rate (under one year of age), deaths per 1000 live births, for the United States for the year 1921, and the estimated mortality rate for the infants of mothers receiving preconception pelvic irradiation, arranged according to the cause of death. Note that the mortality rate for the United States was considerably higher than the rate for the children of irradiated mothers, while the mortality rates for the two groups of children dying in early infancy and from malformations were almost the same.

consisted of an anencephalic stillborn child[3] and a hydrocephalic mongol,[12] both born after maternal *radium* therapy; a microcephalic idiot,[7] a child with a malformed head,[1] 2 children with heart defects,[20,22] and one child with a congenital tracheal defect,[22]—all born after roentgen therapy.

Congenital malformations of the types just mentioned occasionally occur in children without any apparent cause. The frequency of the occurrence of such malformations or pathological conditions in the general population cannot be estimated, and for this reason it is impossible to determine whether the defects in the children just mentioned would or would not have occurred regardless of the irradiation. On the other hand, the fact that only 7 (1.6 per cent) out of a total of 417 children exhibited congenital or other gross anatomic defects that did not conform to any certain type would seem to indicate that the irradiation was not a factor in their causation. It is our belief that if the irradiation had had any deleterious effect upon the germ cells of these children, malformations and other serious developmental disturbances would have occurred with greater regularity, frequency, and uniformity. It cannot be stated with certainty, however, that preconception pelvic irradiation is entirely free from danger to subsequent offspring. Two reasons are responsible for this uncertainty: first, because a few gross defects have been observed in children born after such maternal treatment, and second, because it has been demonstrated *experimentally* that irradiation may give rise to various genetic changes and mutations in the offspring of subsequent generations.

Morbidity and mortality statistics for children of *various ages* that could be compared with the estimated morbidity and mortality rates for the children born after maternal irradiation would be of great value in a study of this nature. Unfortunately, such statistics for children of various ages are not available. However, the estimated mortality rate for the children of various countries under one year of age *born after irradiation* may be compared with the infant mortality rate of the United States since the rate here is lower than the rate of most European countries. In the year 1921 the infant death rate for the United States was estimated at 78.67 per 1000 live births.[32] The infant mortality rate of the 406 live births occurring *after preconception pelvic irradiation* has been estimated as 49.2 per 1000 live births. The infant mortality rates for the group of children *born after irradiation* and for the United States Birth-Registration Area in 1921, classified *according to causes of death*, are shown in

Table XIII. From this it will be seen that the mortality rate for the United States is considerably greater than the rate for the children here studied, but that the death rates from *malformation* and *from causes operating in early infancy* are almost equal. These facts might be taken as an indication that the mortality rate for children under one year of age born of mothers who received irradiation prior to pregnancy was not influenced by the treatment.

A number of leading European radiologists and gynecologists, in personal communications to us, have expressed opinions of a controversial nature regarding the rôle played by *preconception* maternal irradiation as a cause of defects in subsequent offspring. Among the observers favoring the view that such radiotherapy *does not cause* damage to subsequent offspring may be mentioned Fraenkel,[25] Heimann,[10] and Kupferberg.[28] Among those who believe that such irradiation is fraught with danger are Werner,[22] Pankow,[14] and Kraul.[27]

SUMMARY

The various maternal influences and other factors underlying the cause of the ill-health of 46 children born after *preconception pelvic roentgen or radium therapy* have been carefully investigated. The probable causative factors in the production of the ill-health were ascertained in 24, or 52 per cent, of the children, whereas in the remaining 22 children they remained undetermined. This latter group formed only 5 per cent of the entire group of 417 children born after preconception pelvic irradiation. In this small group of 22 children there were only 7 who exhibited gross anatomic defects. Whether the irradiation played a rôle in the causation of these defects could not be learned. The infant mortality rate for the children born after irradiation was *considerably lower* than the mortality rate for the United States; hence the infant mortality rate was apparently not influenced by the irradiation.

It is conceivable that therapeutic pelvic *preconception* irradiation, by its deleterious influence upon the germ-plasm of the unfertilized ovum, may be the cause of defects in subsequent children, since a few disturbances of unexplainable origin occurred in the children under investigation. Experimental study may eventually throw more light upon this, at present, theoretic possibility. We believe that the use of roentgen rays or radium for the treatment of pelvic diseases in the nonpregnant woman of child-bearing age may continue to be justifiable until it has been shown, beyond doubt, that such irradiation is prejudicial to the health of subsequent offspring.

CONCLUSIONS

The following facts and observations were brought out by this investigation:

1. Twenty-four per cent of 650 pregnancies associated with pelvic radium or roentgen irradiation (preconception or postconception in time) ended in abortion; 13 per cent terminated in the birth of unhealthy children.

2. One out of every 10 or 11 children born after *preconception* pelvic irradiation was unhealthy, whereas one out of every 2 children born after *postconception* irradiation was unhealthy.

3. The ill-health of 24 of the 46 unhealthy children born after *preconception* irradiation was attributed to such influence as the following:

a. Six cases of child health disturbances were found to be due to maternal ill-health prior to irradiation or during pregnancy.

b. The ill-health of 13 children was believed to have been the result of complications incident to delivery or of prematurity.

c. In 3 cases the ill-health was believed to be the result of accidental causes.

d. Two unhealthy children later became healthy.

4. The etiology of the ill-health of 22 children could not be determined. In this group there were only 7 seriously defective children.

5. Only one child out of every 59 children born after *preconception* irradiation exhibited some gross anatomic defect of unknown origin. In this small number (one in 59) of defective children the disturbance may have been caused by the previous ovarian irradiation, but it is our belief that if the irradiation had

been the etiological factor in the production of the condition, the defects would have occurred with greater frequency, regularity, and uniformity.

6. Finally, it cannot be stated with certainty that preconception maternal pelvic irradiation is entirely free from danger to subsequent offspring because of the occurrence of a few defective children born after such treatment.*

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* No effort has been spared to secure detailed information concerning every child reported upon in this communication. The literature has been reviewed, and personal letters have been written to all observers who reported such cases. The lack of information in a number of instances is due either to the fact that the observers did not have the sought-for data or to failure on their part to respond to our inquiries. We are glad, however, to acknowledge our thanks to the many observers who, in forwarding us information concerning the unhealthy children, made the completion of this study possible.

LATE EFFECTS OF TREATMENT OF THYMUS*

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WITHIN the past few years several reports have appeared of early untoward symptoms arising following radiation treatment of the thymus. Hardy[3] reported reactions in 6 out of 18 cases treated with radium. Konikow[5] attributed the onset of fatal tetany to roentgen irradiation of the thymus and suggested that the parathyroids might have been injured. Dannenberg[1] adds a fatality and mentions several other cases which developed varying degrees of somnolence following irradiation.

More recently Hess[4] has called attention to another type of reaction: the development of Mongolian idiocy following irradiation. Two cases were reported which had received rather heavy irradiation and progressively developed idiocy starting in the second year after treatment.

This latter type of reaction is of particular interest for there has long been a feeling among a number of clinicians that thymic function is closely related to Mongolian idiocy. Furthermore, should this type of retardation occur with any frequency following irradiation of the thymus, we would of necessity have to ascribe to the gland a more important place in the field endocrinology than it now occupies.

Despite the fact that an extensive literature has been built up around nearly every phase of diagnosis and treatment of enlarged thymus glands, practically nothing was found dealing with the possible late effects. Such a study would seem indicated not alone from the point of view of irradiation sequelae but should also be interesting as a study of known thymic individuals.

For these reasons 200 cases which had received fairly large doses of radiation for definitely enlarged thymus glands were followed up. These patients had been treated at some time between 1920 and the first three months in 1925. Of the 200, nearly one-half, or 90 cases, were traced and communicated with.

For the present study still further limitations were drawn. First, the patients must have been, as far as ascertainable, normal individuals or at least have been suffering from a reparable abnormality before treatment was given. The one exception to this rule was that thymicolymphatic types were ruled in. Second, the patients must have been in the first seven years of life at the time of treatment. This we felt would be more apt to bring out any sequelae which might result from treatment. With these restrictions imposed, 67 cases remained for analysis and 4 of these had died during the first three years after treatment, one following an operation and 3 of pneumonia.

The group for analysis then consists of 63 cases treated with fairly large doses of radiation between three and a half and eight years ago.

METHOD OF FOLLOW UP

Questionnaires were prepared with a view to ascertaining the present and interval state of health. The questions were worded in such a manner that all suggestions were avoided. Most of the answers received from the parents or guardians were based on a doctor's opinion. As will be seen from Table 1, a number of these children suffered from primary conditions, the nature of which would keep them under medical supervision. Several of the replies contained cards or papers from public school medical examiners stating the present condition of the child, while a larger majority either have at present, or have had in the past, illnesses which would necessitate being seen by a doctor.

In Table 1: The age of the child upon entrance represents within one month the age at which treatment of the thymus was started. Columns 7 and 8 present the roentgenographic and clinical evidence of enlarged thymus. Nearly all roentgenographic diagnoses were made from flat anteroposterior chest films. The clinical

* From the Department of Roentgenology, University of Michigan Hospital, Ann Arbor, Mich.

Table 1

1. Number
2. Sex
3. Age at time of treatment
4. Age at present
5. Time elapsed since treatment
6. Reason for entering hospital
7. Roentgenograms of chest expressing presence or absence of thymic shadow.
8. Clinical symptoms of thymic enlargement
9. Number, amount and intervals of treatment
10. Further roentgen treatments
11. Diseases since leaving hospital
12. Grade in school
13. Weight in pounds at present
14. Height in inches at present
15. Comments on present health

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	F	1 wk.	6 yrs.	6 yrs.	Thymic paroxysm	−	++	2 × 50%, 1 wk. interval	−	Pertussis, measles	1A	48	47	Healthy
2	M	3 wks.	Dead	.....	Cleft palate	+	−	2 × 50%, 4 days interval	−	Pneumonia	Died at 9 months			
3	M	7 wks.	6½ yrs.	6½ yrs.	Cleft palate	+	−	3 × 50%, 1 wk. interval	−	Scarlet fever, measles	1A	54	55	Chronic otitis media
4	M	2 mos.	6½ yrs.	6½ yrs.	Cleft palate	+	−	3 × 45%, 1 wk. interval	−	Scarlet fever, pneumonia, varicella	1A	53	46	Malocclusion, slight deafness
5	M	2 mos.	5 yrs.	5 yrs.	Cleft palate	+	−	3 × 40%, 1 wk. interval	−	Pertussis, pneumonia	K	33	39	Healthy
6	F	2 mos.	3½ yrs.	3¼ yrs.	Cleft palate	+	−	2 × 25%, 4 days interval	−	—	−	31	36	Slight defect in palate
7	F	3 mos.	7 yrs.	6¾ yrs.	Cleft palate	+	−	2 × 35%, 1 wk. interval	−	Pertussis, measles, tonsillitis	−	47	45	Has speech defect
8	M	3 mos.	5½ yrs.	5¼ yrs.	Cleft palate	++	−	2 × 40%, 1 wk. interval	−	Varicella, pneumonia	−	42	45	Healthy
9	M	3 mos.	6⅛ yrs.	6 yrs.	Cleft palate	+	−	3 × 30%, 1 wk. interval	−	—	K	46	45	Slight speech defect
10	F	3 mos.	7¼ yrs.	7 yrs.	Spina bifida, cervical	++	−	2 × 50%, 1 wk. interval	−	Measles, varicella, pertussis	2B	62	48	Slight ataxia hands and feet
11	M	4 mos.	Dead	.....	Lymphangioma	++	+	3 × 40%, 1 wk. interval	.....	Child died at age of 2½ yrs. following operation. Was typical thymicolymphatic child.				
12	M	4 mos.	5 yrs.	4⅝ yrs.	Club-feet	+ +	+ +	3 × 40%, 2 wks. interval	−	Pertussis, measles	−	39½	41	Healthy
13	F	4 mos.	6½ yrs.	6 yrs.	Thymic syndrome	++	++	5 × 30%, 4 days interval	For asthma when 2½ years old	Pertussis, varicella	2B	55	48	Asthmatic attacks since infancy
14	F	5 mos.	Dead	.....	Cleft palate	+	+	3 × 40%, 1 wk. interval	−	Pneumonia	Died when 15 mos. old			
15	F	6 mos.	6¾ yrs.	6¼ yrs.	Cleft palate	+	−	1 × 50%	−	Scarlet fever	1B	43½	45	Healthy
16	M	6 mos.	7 yrs.	6½ yrs.	Cleft palate	+	−	2 × 50%, 1 wk. interval	−	Measles	1B	44	45	Healthy
17	M	6 mos.	6 yrs.	5½ yrs.	Club-feet	++	−	3 × 30%, 1 wk. interval	−	Pertussis, measles, mumps	1A	48	—	Healthy
18	F	7 mos.	6½ yrs.	6 yrs.	Feeding problem	−	+	2 × 30%, 1 wk. interval	−	—	1B	39	42½	Healthy
19	M	7 mos.	7 yrs.	6½ yrs.	Foreign body, left bronchus	+	+?	2 × 35%, 2 days interval; 1 mo. later 2 × 30%, 1 wk. interval	−	Scarlet fever, mumps, pertussis, measles	1B	49	46	Chronic otitis media, dyspnea on exertion
20	M	8 mos.	5½ yrs.	4⅝ yrs.	Club-feet, phimosis	+	−	3 × 40%, 3 wks. interval	−	Measles, mumps, diphtheria	K	35	39	Healthy
21	F	9 mos.	9 yrs.	8 yrs.	Cleft palate	++	−	3 × 40%, 3 days interval	−	—	1	48	—	Seropurulent nasal discharge, pale, pasty, has choking attacks
22	F	10 mos.	6 yrs.	5 yrs.	Congenital deformity left leg	+	−	3 × 40%, 3 wks. interval	−	—	−	48	45	Had leg amputated, otherwise normal
23	F	1 yr.	5 yrs.	4 yrs.	Thymic paroxysm	+	++	1 × 40%	Nine treatments elsewhere in a year for thymus	Varicella	−	38	40	Thymism disappeared after two treatments Healthy
24	M	1 yr.	4½ yrs.	3½ yrs.	Cleft palate	+	−	2 × 25%, 1 wk. interval	−	—	K	46	43½	Healthy
25	F	1 yr.	7 yrs.	6 yrs.	Typhoid fever	+	+	2 × 40%, 1 wk. interval	−	Scarlet fever	3	50	47	Healthy
26	M	1 yr.	8 yrs.	7 yrs.	Pseudoglioma O. D.	+	−	1 × 60%	−	Mumps	2B	50	58	Healthy
27	M	1 yr.	6½ yrs.	5½ yrs.	Spastic tetraplegia	+	−	3 × 40%, 1 wk. interval	−	−	1A	54	46	Chronic otitis following scarlet fever

TABLE 1 (*Continued*)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
28	F	1½ yrs.	6 yrs.	4½ yrs.	Spina bifida, lumbar	+	−	3 × 40%, 1 wk. interval	−	−	1A	45	42	Healthy
29	F	1½ yrs.	6½ yrs.	5 yrs.	Hare-lip	−	+	2 × 30%, 4 days	−	Measles, pertussis	1B	45	44	Healthy
30	F	1½ yrs.	7 yrs.	5½ yrs.	Club-feet	++	+	5 × 45%, 1 wk.	.....	Measles, mumps, pertussis, varicella	1B	52	47½	Healthy
31	M	1¾ yrs.	8¾ yrs.	7 yrs.	Hypospadias	+	−	3 × 50%, 1 wk. interval	−	Measles	2B	52	50	Healthy
32	M	2 yrs.	10 yrs.	8 yrs.	Cleft palate	+	−	1 × 75%	−	−	4th	57	49	Healthy
33	M	2 yrs.	6 yrs.	4 yrs.	Cleft palate	++	−	2 × 45%, 4 days interval	−	Pertussis, measles	−	37	42	Prolonged colds, otherwise healthy
34	F	2 yrs.	10 yrs.	8 yrs.	Peanut in rt. bronchus	+	−	1 × 50%	−	Measles, pertussis, scarlet fever	6th	51½	50	No sequelae
35	F	2 yrs.	8½ yrs.	6½ yrs.	Adenoids and tonsils enlarged	++	−	4 × 50%, 1 wk. interval	−	Pertussis, measles, scarlet fever	4A	61	54½	Malocclusion High arched palate
36	F	2 yrs.	8½ yrs.	6½ yrs.	Cleft palate	+	−	3 × 50%, 1 wk. interval	−	Measles	3B	52	50	Slight defect in palate, speech defect
37	F	2 yrs.	7 yrs.	5 yrs.	Hemangioma, back	+	−	1 × 50%	−	Scarlet fever, measles	3A	36	45	Nervous, underweight
38	M	2½ yrs.	6½ yrs.	4 yrs.	Genu valgum	+	−	2 × 45%, 2 wks. interval	For pertussis when five years	Pneumonia, croup, pertussis	−	36	38	Increased susceptibility to respiratory troubles
39	F	2½ yrs.	9 yrs.	6½ yrs.	Congenital hip	++	+	4 × 50%, 1 wk. interval	−	−	3d	48	47½	Enlarged adenoids and tonsils
40	M	3 yrs.	Dead	.....	Adenoids and tonsils, bronchitis	++	−	3 × 40%, 1 wk. interval	−	Pneumonia	Died when 3½ yrs. old			
41	M	3 yrs.	6½ yrs.	3½ yrs.	Adenoids and tonsils enlarged	+	−	1 × 50%	−	−	1B	35	42	Adenoids, mouth breathing
42	M	3 yrs.	8 yrs.	5 yrs.	Adenoids and tonsils enlarged	+	−	2 × 50%, 2 wks. interval	−	−	3A	61	50½	Cervical adenitis, afternoon fatigue
43	M	3 yrs.	9 yrs.	6 yrs.	Club-feet	++	+	3 × 50%, 1 wk. interval	−	−	3A	75	52	Cervical adenitis
44	M	3 yrs.	8 yrs.	5 yrs.	Ecthyma	+	+	2 × 50%, 1 wk. interval	−	Measles, mumps	4A	83	−	Hay fever, asthma chronic otitis media
45	F	3 yrs.	8½ yrs.	5½ yrs.	Penny in esophagus	+	−	1 × 50%	−	Pertussis, measles	3d	48	49	Healthy
46	F	3 yrs.	9 yrs.	6 yrs.	Adenoids and tonsils enlarged	+	+	3 × 50%, 1 wk. interval	−	Pertussis, measles	4	55	52	Cervical adenitis, chronic throat infection
47	F	3 yrs.	9 yrs.	6 yrs.	Adenoids and tonsils, chronic otitis	+	−	2 × 50%, 4 days interval	−	Pertussis, mastoiditis	4	76	54	Chronic throat infection
48	F	3 yrs.	10 yrs.	7 yrs.	Adenoids and tonsils enlarged	Thymic type +	+	3 × 50%, 1 wk. interval	−	Pertussis, chicken pox	5	75	−	Healthy
49	F	3 yrs.	8 yrs.	5 yrs.	Foreign body right bronchus, nail	+	−	1 × 50%	−	Lung abscess, measles	4	58	52½	Productive cough
50	M	3 yrs.	8 yrs.	5 yrs.	Adenoids and tonsils enlarged	Thymic type +	+	3 × 50%, 1 wk. interval	−	Measles	3	62	49	Healthy
51	M	3½ yrs.	9½ yrs.	6 yrs.	Club-feet	++	−	2 × 50%, 1 wk. interval	−	Measles	5	63	51½	Malocclusion; healthy
52	M	4 yrs.	8 yrs.	4 yrs.	Residual polio paralysis	+	−	3 × 50%, 1 wk. interval	−	Measles, mumps	3	−	−	Healthy, has paralysis
53	F	4 yrs.	10 yrs.	6 yrs.	Adenoids and tonsils enlarged	+	−	3 × 50%, 1 wk. interval	−	−	5	100	60	Healthy

Table 1 (*Continued*)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
54	F	4 yrs.	10 yrs.	6 yrs.	Cleft palate	+	−	1 × 50%	−	Measles, chicken pox	5	64	53	Mouth breather
55	F	4 yrs.	9 yrs.	5 yrs.	Adenoids and tonsils enlarged	+	−	2 × 50%, 1 wk. interval	−	Measles, varicella	3	59	51	Nervous, irritable child
56	M	4 yrs.	9 yrs.	5 yrs.	Cleft palate	+	−	2 × 50%, 1 wk. interval	−	Measles, pertussis	4	64	52	Healthy
57	M	4 yrs.	9 yrs.	5 yrs.	Carious teeth, enlarged thymus	++	+	4 × 50%, 1 wk. interval	−	—	3	69	53	Mouth breather
58	M	4 yrs.	9 yrs.	5 yrs.	Prolapsed rectum	+	−	3 × 50%, 2 wks. interval	−	Pertussis	2B	49	57½	Healthy
59	F	4 yrs.	8 yrs.	4 yrs.	Adenoids and tonsils enlarged	++	−	3 × 40%, 2 wks. intervals	.....	—	2	66	51½	Healthy
60	M	4½ yrs.	9½ yrs.	5 yrs.	Adenoids and tonsils enlarged	+	−	2 × 50%, 1 wk. interval	−	Measles, mumps	4A	70	54	Healthy
61	M	5 yrs.	10 yrs.	5 yrs.	Adenoids and tonsils enlarged	+	−	3 × 50%, 1 wk. interval	−	Measles, varicella	4	97	61	Healthy
62	F	5 yrs.	11 yrs.	6 yrs.	Adenoids and tonsils enlarged	−	+	2 × 50%, 2 wks. interval	.....	Measles, mumps	6	62	52	Frequent gastrointestinal disturbances
63	M	6 yrs.	11 yrs.	6 yrs.	Adenoids and tonsils enlarged	+	−	3 × 60%, 1 wk. interval	−	Measles	3	70	53	Hearing defect
64	F	6 yrs.	11 yrs.	5 yrs.	Adenoids and tonsils enlarged	+	−	2 × 50%, 1 wk. interval	−	Mumps	6	57	52½	Healthy
65	M	6 yrs.	11 yrs.	5 yrs.	Rt. inguinal hernia	+	−	2 × 50%, 1 wk. interval	−	Mumps	5	76	50	Hearing defect
66	F	6 yrs.	11 yrs.	5 yrs.	Adenoids and tonsils enlarged	+	−	3 × 40%, 10 days interval	−	Measles, varicella	7	75	56	Healthy
67	F	6 yrs.	11½ yrs.	5½ yrs.	Adenoids and tonsils enlarged	+	−	3 × 50%, 1 wk. interval	.....	Variola, measles, mumps	5A	73	59	Healthy

evidence of thymic enlargement was made up of those commonly accepted signs: transitory cyanosis, dyspnea, croupy cough, choking or breath holding. Despite the feeling expressed by Torrey[6] that convulsions without fever or apparent cause are frequently due to an enlarged thymus, these cases were not admitted to the present group as we wished to avoid any possible overlapping of thymic and spasmophilic syndromes.

The number, amount and intervals between treatments are shown in column 9. The treatments were given with a 9 inch gap (blunt points), 5 ma., 12 inch distance and usually 3 mm. Al filtration. About 10 per cent of the group received treatment with 2 mm. Al filtration.

The amount is expressed in percentage of the erythema dose in use at that time.* As closely as we can calculate in retrospect this erythema represented about 350 r, ± 25 per cent. The interval between each treatment is indicated. The notation, 3 × 40 per cent, one week interval, would therefore mean that the patient had three treatments at one week intervals, each of 40 per cent.

All treatments were given over the upper anterior mediastinum. Very few of the patients received roentgen treatments after their first course. However, when more radiation was administered for any reason, note is made of this fact in column 10.

The named illnesses which the child has had since leaving the hospital are listed in column 11. These data should aid in analyzing the present mental and physical status shown in 12, 13, 14 and 15 and are also of interest in connection with the alleged function of the thymus in combating infections. Grade in school

* Communication with the radiologists who administered these treatments, Drs. S. W. Donaldson, Clyde Haseley and Carrol Davenport, show that during this period the dose was not changed and that the radiation administered produced a threshold skin reaction when the full erythema dose was given.

is given in column 12, while weight in pounds and height in inches are shown in columns 13 and 14 respectively.

It will be seen from Table 1 that the

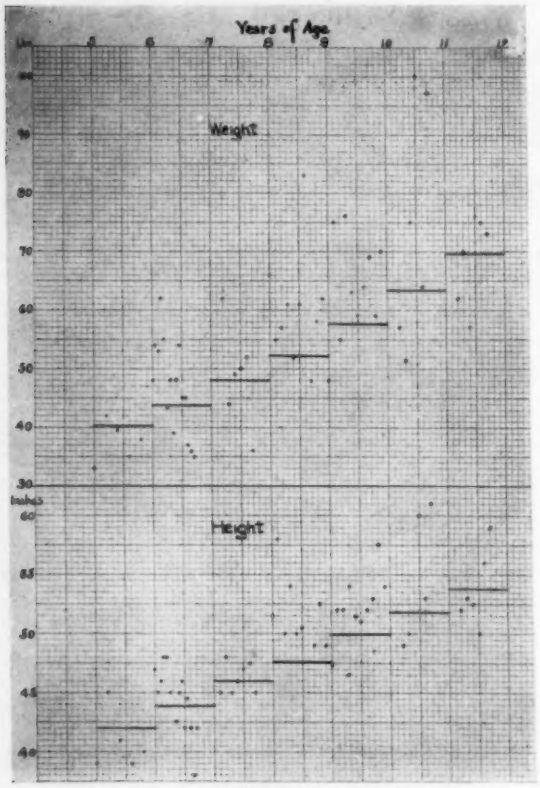

CHART 1.

sexes are equally represented, the group containing 31 males and 32 females. However, for purposes of comparison with untreated children this sex grouping is not strictly necessary as the normal variations within the groups are greater than the variations existing between the sex groups. Classing the patients according to age at time of treatment, we find that 19 were under one year, 9 between one and two years, 8 between two and three years, 11 between three and four years, 9 between four and five years, and 7 between five and seven years.

DISCUSSION

The grade in school was used to determine whether or not mental changes occurred in these children. It is assumed that the average child enters the first grade sometime between five and a half and six and a half years. The entrance age, however, is not so important in grading mental activity as is the promotion rate after entrance. Bearing in mind that intercurrent infections and physical defects may have an appreciable effect on the child's standing in school, we find that these children are in normal age—grade groups with four exceptions. Cases 7, 21, 63 and 58 fall below the expected level. The first three mentioned have sufficient physical handicap to account for their backwardness while the fourth is a year behind his class for no evident reason. It would seem then that there are no marked mental deviations in this group.

The physical development of the children may be expressed in weight and height tabulation and these results compared with one of the well-known tables of normals.

The norms for weight and height were taken from tables collected and published by Griffeth and Mitchell[2]. For the two children below five years of age, No. 6 and No. 24, the tables of Camerer were used. The younger child, aged 3½, compares quite favorably with this set of norms. The older, 4½ years, is considerably larger than the average for his age. Upon comparing this child with the Children's Bureau statistics, we find that in height he is from one to one and one-half years more advanced than the average.

For comparison of the remainder of the group, the tables of Peckham were used, and rather than split our group into males and females, an average of weight and height was struck between the two sexes. Peckham's two sets of norms are close enough and parallel each other to such an extent that this computation introduced in both height and weight an error of less than ± 3 per cent. These averages are shown in Table II.

The individual cases were then point charted against the normal step ladders of weight and height (Chart 1).

This chart is arranged in such a manner that the individuals are on the vertical. By dropping a vertical then from the point on the average weight ladder we find the same child's position in relation

Table II

Age, Yr.	Weight, Lb.	Height, In.
5	40.11	42.0
6	43.86	43.9
7	48.00	46.0
8	52.20	47.6
9	57.90	49.9
10	63.40	51.8
11	69.80	53.8
12	77.00	55.7
13	86.50	58.0
14	96.70	60.0
15	107.00	61.9

to the height ladder. Solid lines represent normals, dots represent individuals.

In the largest three groups, six, eight and nine years, it will be noticed that the average of the group is noticeably higher than normal. Several individuals are outstandingly large for their age and might well be placed in a group three or four years older. It will be seen, however, that these children fall in the proper school group for their age.

It might be that endocrinological factors of the pituitary-thymus-sex gland linkage play a part in this general increased stature and in some of the children this is certainly strongly suggested. However, a more logical interpretation for the majority of the group would be that these children, on account of their original defects, had received somewhat better care and feeding than the average.

The defects which these children show at the present time are for the most part attributable to their primary complaint or to intercurrent disease. It may be seen that no constant type of change is found; therefore, it is quite likely that treatment of the thymus cannot be implicated as a causative factor in any of these defects.

CONCLUSIONS

A study of 63 children who received treatment of the thymus from three and a half to eight years ago fails to demonstrate any constant deviation from normal, in either the physical or mental spheres, which might be attributed to the treatment.

The dosages used, while somewhat high in the light of our present knowledge, are apparently within the range of safety.

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PULMONARY TUBERCULOSIS OF INFANTS AND CHILDREN

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SOURCE OF MATERIAL

THIS treatise is based on proved pulmonary tuberculosis at the Children's Hospital. The illustrative cases are chiefly taken from a series of more than 100 autopsies. Now and then an instance is mentioned in which the diagnosis was established by finding the tubercle bacillus. Most of the cases have been studied by serial roentgenograms for weeks, months or years prior to post-mortem examination.

GENERAL ROENTGEN PATHOLOGY OF PULMONARY TUBERCULOSIS

The earliest lesions of tuberculosis in adults occur as indistinct, multiple shadows somewhere in an upper lobe. Less frequently they may be solitary and circumscribed. They are usually circular and vary from the size of a millet seed to several centimeters in diameter. At first the shadows are faint. Invariably they are surrounded by a zone of exudative inflammation. As involution proceeds the inflammatory zone disappears and the shadows become sharper. Caseation causes them to become denser. They next decrease in size, the smallest lesions disappearing. With healing the larger lesions will show fibrosis or calcification. Ultimately there may remain only a single strand of scar tissue.

In the manifold forms of the disease which result from its gradual or rapid extension, three types of reaction are distinguished:

1. *The proliferative form* is that of incipient disease. Its prototype is the tubercle, a small, faint, nodular shadow of varying size, often surrounded by a pneumonic zone.

2. *The exudative form* is represented by the acute specific inflammatory reaction which is commonly associated with a rapid dissemination of the disease. Its shadows are dense and homogeneous, often involving large areas of the lung. It accompanies to a slight degree most cases of the proliferative type, but it may exist alone as an exudate in the air vesicles with no tubercle formation. It may be resorbed but is usually the precursor of caseation and cavity formation and ominous in its import.

3. *The fibrous form* is the indurative or healing type, seen to some extent in roentgenograms of all but the most acute processes. In chronic cases it is associated with caseation and cavity formation, appearing as dense bands or coarse strands, causing retraction of the lung and deformities.

The secondary changes are caseation and calcification. The former manifests itself by an increase in density and in proliferative lesions, an added definiteness of outline.

Calcification of tuberculous infiltrations is the best evidence of healing. Its shadows are very dense, sharp and irregular. It confers upon glandular shadows a stippled, stratified, or lamellated density.

CONCEPTION OF THE DISEASE IN INFANTS AND CHILDREN

The conception which emphasizes the similarity in sequence of manifestations between tuberculosis and syphilis, each exhibiting a primary, secondary and late stage, is preferred. One may then outline the events which follow the entrance of the tubercle bacillus into the lung. If the attack is massive the child is overcome by an acute caseous rapidly fatal disease. If the invasion is mild, there results a primary lesion of small extent, situated anywhere in the lung, which usually goes on to cure by fibrosis or calcification. Coincident tuberculous adenopathy may remain latent or may manifest itself clinically some time after the primary focus has healed. Towards puberty or more commonly in early adult life, late infection of the lungs may occur either from mobilization of tubercle bacilli in the

Fig. 1. Calcified primary lesion right upper lobe of child aged four years. Also calcified lesion of left upper lobe with surrounding recent infiltration. Autopsy case studied by serial roentgenograms for three years.

bronchial nodes or by massive infection from without.

CLASSIFICATION

Pulmonary tuberculosis in infants and children may be classified according to the appearance and distribution of the infiltrations on the roentgenogram. Table 1 has been found to cover our material at the Children's Hospital.

Table 1

CLASSIFICATION OF PULMONARY TUBERCULOSIS IN INFANTS AND CHILDREN

Roentgen Type	Stage of Disease		
Primary tuberculosis			
(a) primary lesion	I		
(b) caseous pneumonia	I	II	
Glandular tuberculosis			
(a) in infancy	II		
(b) in childhood	II		
Hilus tuberculosis			
(a) in infancy	I	II	
(b) in childhood	II		
(c) recurrent pneumonia	II		
(d) basal distribution	I	II	III
Miliary tuberculosis			
(a) pulmonary	II	III	
(b) accompanying tuberculous meningitis	II	III	
Adult tuberculosis	III		

PRIMARY TUBERCULOSIS

Focal Primary Lesion. The initial lesion of tuberculosis is almost always undetected. Its small size renders its recognition by physical examination impossible and its symptoms are mistaken for those of the numerous respiratory or other infections. One is fortunate to discover such lesion while it is still active, as it usually heals rapidly. The roentgenogram will show a pneumonic infiltration of moderate extent which may occur in any lobe. It may be multiple. More frequently the healed remains of the primitive infiltration are detected (Fig. 1), though in the greater number of cases it becomes invisible because of its size. Often it is represented only by a strand of fibrous tissue, generally in an upper lobe. Not infrequently the pleura in the region of the site of the initial lesion is involved. A sharp linear shadow traversing the chest from midline to axilla may be suspected of previous tuberculous infection in its vicinity. The so-called Ghon's tubercle seen in roentgenograms of adults and assumed to be the calcified remnant of a primary lesion is usually situated in a lower lobe.

Caseous Pneumonia: Infantile Phthisis. Before pathological studies revealed the frequency of pulmonary infection in the early months of life and increasing year by year, tuberculosis in infancy was regarded as almost invariably fatal. We now know that even in infancy an advanced tuberculous process may heal (Figs. 2*a* and 2*b*). The susceptibility, however, to massive infection is very great, and it may terminate in a most extensive caseous consolidation and necrosis of the lung (Figs. 3*a*, 3*b* and 3*c*). Whether this is the result of primary infection or is secondary cannot always be deduced from the roentgenogram. Undoubtedly in some cases it results from rupture of a caseous lymph node into a bronchus. The process is usually rapidly fatal. Caseous pneumonia comprised about 20 per cent of the autopsy series. Spontaneous pneumothorax complicated one case.

TUBERCULOSIS OF THE INTRATHORACIC LYMPH NODES

By far the most common diagnosis in clinical records, tuberculosis confined to the intrathoracic lymph nodes registered a low score in the autopsy series. The roentgenogram is indispensable in its diagnosis. The diseased lymph nodes in all their variety of size, shape, and position are projected as dense shadows extending

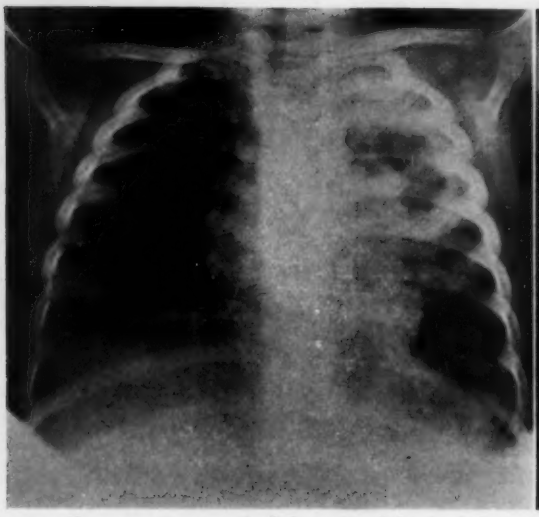

FIG. 2a. Caseous pneumonia left upper lobe in infant aged seventeen months. Cavity 4 cm. in diameter. Miliary lesions in left lower lobe. Sputum obtained by swab method positive.

FIG. 2b. Same case as Figure 2a three years later Scar in left upper chest. Child still well six years after lesion healed.

beyond the mediastinum into the pulmonary field.

In infants tuberculous adenopathy is unique. The enlargement is relatively greater than in children, the glandular mass often assuming the dimensions of a neoplasm (Figs. 4*a*, 4*b*, 4*c*, 4*d* and 4*e*). The bronchopulmonary group of glands lying within the lung fields close to the borders of the heart bears the brunt of the infection. The upper tracheobronchial group is next most frequently attacked. The lower tracheobronchial group is obscured by the heart shadow and is ordinarily not visible except in the lateral view (Fig. 6*d*). It should be noted that glandular enlargement is generally greater on the right than on the left.

Tuberculous hilus glands may cause all the phenomena commonly associated with foreign body in the air passages. One may see with the roentgenoscope all degrees of disturbance of respiration from the slightest lateral shifting of the heart shadow to well-marked air trapping, or complete occlusion of a bronchus (Figs. 6*a*, 6*b*, 6*c* and 6*d*).

Passing from infants to children, the problem of diagnosis of tuberculous hilus glands becomes more difficult. It can rarely be stated from the roentgenogram whether disease of the intrathoracic lymph nodes is the cause of the symptoms present. There may be no correspondence between the size of the glands and the severity of clinical symptoms. Neither can enlargement of tuberculous nodes always be distinguished from moderate tumefaction of hyperplastic lymph nodes, particularly in the absence of caseation or calcification. Enlarged bronchical nodes may be so situated as to obstruct and distend effluent pulmonary vessels and lymphatics, producing a picture similar to that of chronic valvular disease. Such broadened markings extending into the upper lobes are often interpreted as tuberculosis spreading outward from diseased lymph nodes. They are a common occurrence on the roentgenograms of glandular enlargement accompanying bronchial asthma and nasal accessory sinus disease and are not specific for tuberculosis.

In view of the above admissions, the question may arise as to the value of the roentgenogram in hilus gland tuberculosis of children. It shows whether there is actually pulmonary disease, or whether the infection is confined to the bronchial nodes, thereby differentiating a grave condition from a benign one. Repeated roentgenograms are of great value in studying progress. Disappearance of the hilus gland shadows and increased calcification are indications of favorable progression.

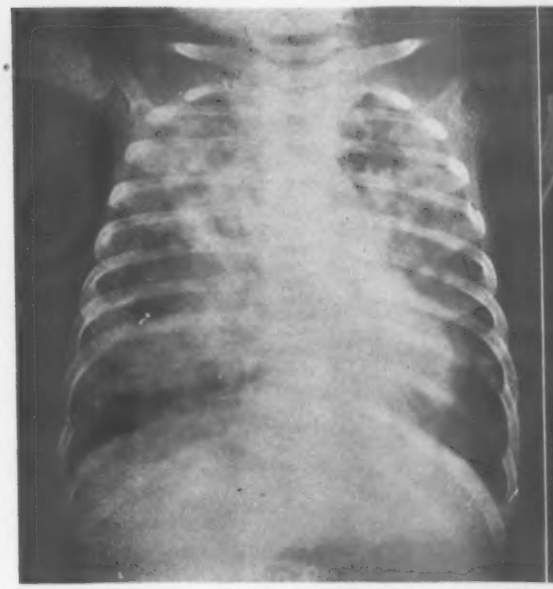

Fig. 3a. Caseous pneumonia both lungs, infant aged five months. Large cavity upper portion right lower lobe. Autopsy case.

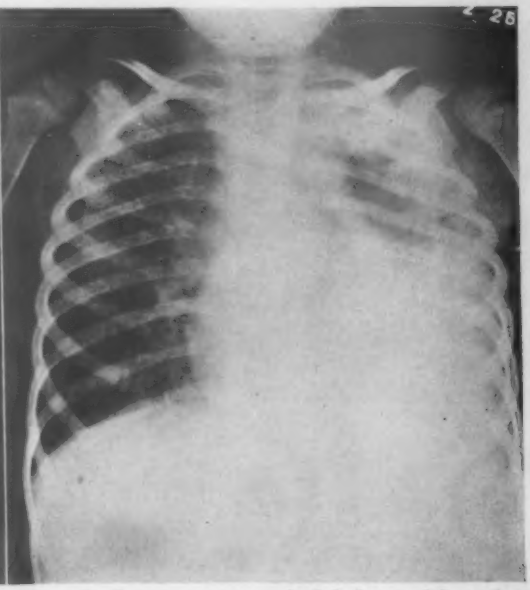

Fig. 3b. Caseous pneumonia left lung with cavitation of upper lobe in child aged three and one-half years. Miliary tuberculosis right lung. Autopsy case.

While the shadows of caseous hilus glands in infants are frequently so characteristic as to be diagnostic, in children the diagnosis of hilus gland tuberculosis should scarcely be made from the roentgenogram alone. Contact with an open case of pulmonary tuberculosis plus a positive intradermal tuberculin reaction are usually quite necessary before one may consider bronchial gland enlargement of tuberculous origin. Calcification rarely, if ever, occurs in other than tuberculous hilus glands.

HILUS TUBERCULOSIS

Hilus tuberculosis is a much more common form of the disease in early than in adult life. But for the roentgen ray it would usually be undiscovered. It constitutes more than 30 per cent of the autopsy cases. The process originates at the root of the lung and extends outward a variable distance.

In infants it consists of a cheesy tuberculosis of the lung root tissues, rapidly progressive, with a bad prognosis. The triangular shadow of ordinary infantile pneumonia has its base at the periphery, whereas in hilus tuberculosis it is at the root (Fig. 7). In our series the location was nearly always right sided.

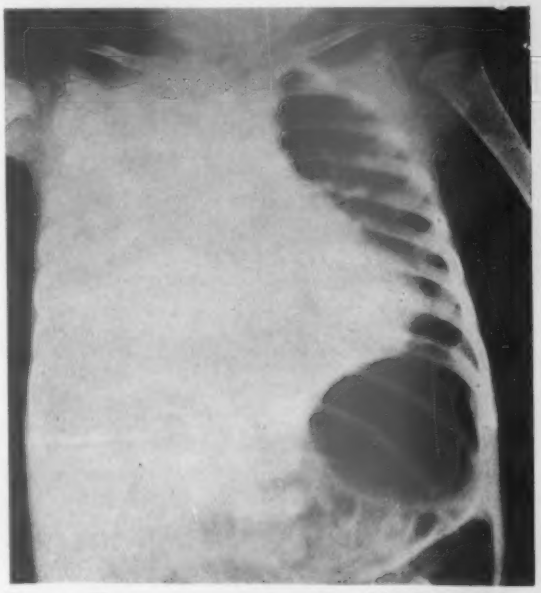

Fig. 3c. Caseous pneumonia entire right lung without cavitation in infant aged eighteen months. Autopsy case.

A second type of hilus tuberculosis occurs in childhood, most commonly around the age of six, a relatively mild infection with a good prognosis.

Recurrent hilus pneumonia of tuberculous origin: perifocal tuberculosis: paratuberculosis: epituberculosis, is an interesting process characterized by the recurrence of

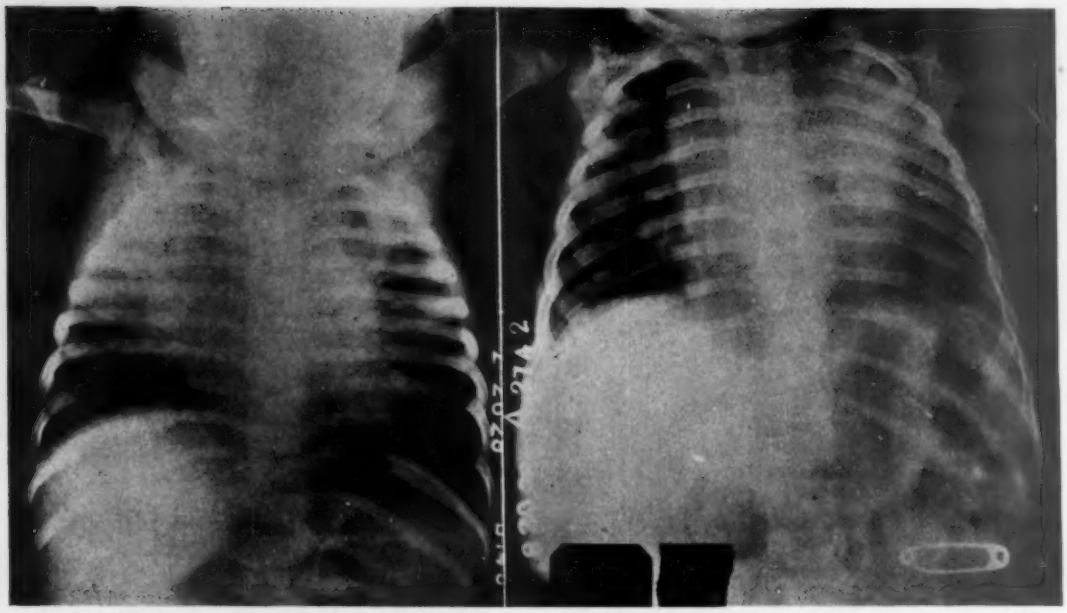

FIG. 4a. Extensive caseous peribronchial and peritracheal gland tuberculosis in infant aged fourteen months. Thymus extensively involved. Few early miliary lesions left apex. Right apex atelectatic. Autopsy case.

FIG. 4b. Extensive caseous peribronchial and peritracheal gland tuberculosis in infant aged two years. Autopsy case.

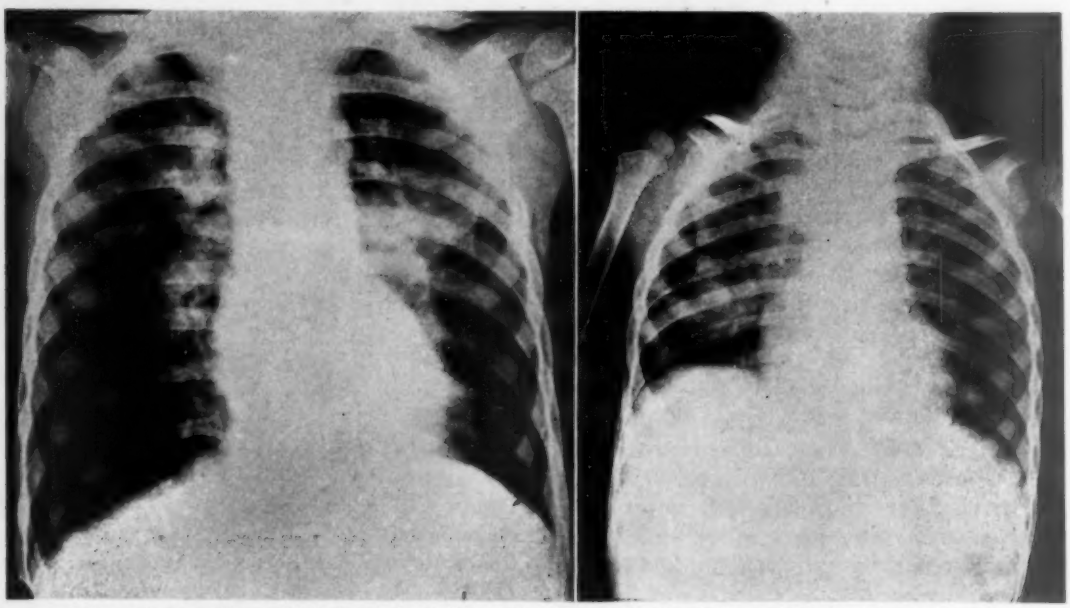

FIG. 4c. Tuberculous peribronchial glands in child aged three years. Autopsy case.

FIG. 4d. Partially calcified right tuberculous paratracheal gland in child aged two and one-half years. Tuberculosis right lower lobe. Autopsy case.

symptoms of pulmonary infection at intervals of weeks or months during which there may be varying degrees of cough, fever, and at times a few physical signs. It affects both infants and children. Pathologically the process is an exudative one about a tuberculous lymph node, usually not due to a dissemination of tubercle bacilli but to a cellular reaction around the central focus containing the infecting organism.

Fig. 4e. Caseous right paratracheal lymph gland in infant aged seven months. Autopsy case.

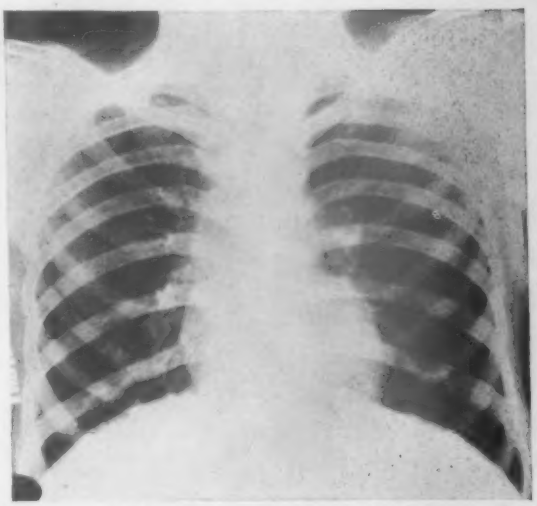

Fig. 5. Calcified bronchopulmonary glands in child aged eleven years. Autopsy case.

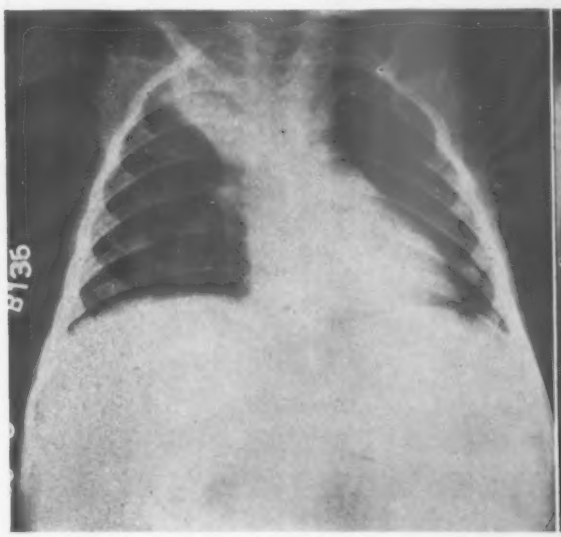

Fig. 6a. Caseous right peribronchial gland causing air trapping by partial obstruction to right middle and lower lobe bronchi and collapse of right upper lobe by complete obstruction to right upper bronchus in infant aged sixteen months. Autopsy case.

Fig. 6b. Infant aged nineteen months. Air trapping both lungs and severe respiratory stridor. Bronchoscopy revealed a bulging inward of anterior wall of trachea leaving narrow semicircular slit for respiration. Autopsy showed caseous lymph gland obstructing trachea on right. The shadow to left of spine is thymus. Lateral view of chest failed to show narrowing of tracheal shadow.

The bacillus is not found in the infiltrated zone, the tissues being saturated with serum and lymphocytes, thus accounting for the complete disappearance of shadows by absorption. The process is consequently benign and always accompanied by an intense skin reaction to tuberculin. Not all hilus pneumonias of the recurrent type are entirely free from tubercle bacilli, as not infrequently they leave in their wake fibrous change, increased vascularity or a small calcified area to mark the center of the previous process. Recurrences of benign tuberculous hilus pneumonias may eventually be followed by a rapidly destructive infiltration ending fatally (Fig. 8).

Tuberculosis of the lower lobes without coincident involvement of the apices is a more frequent happening in early than in

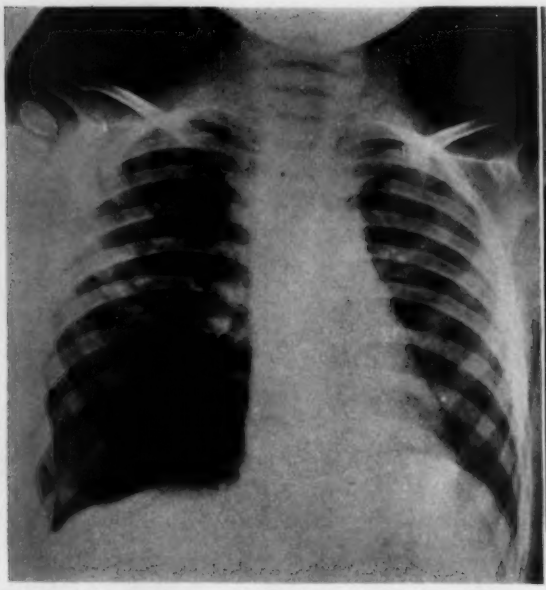

FIG. 6c. Air trapping on right, infant aged two years. Tuberculosis lower portion right upper lobe. Bronchoscopy showed pressure on trachea and narrowing of right main bronchus with granulation tissue. Specimen removed for diagnosis showed tuberculosis.

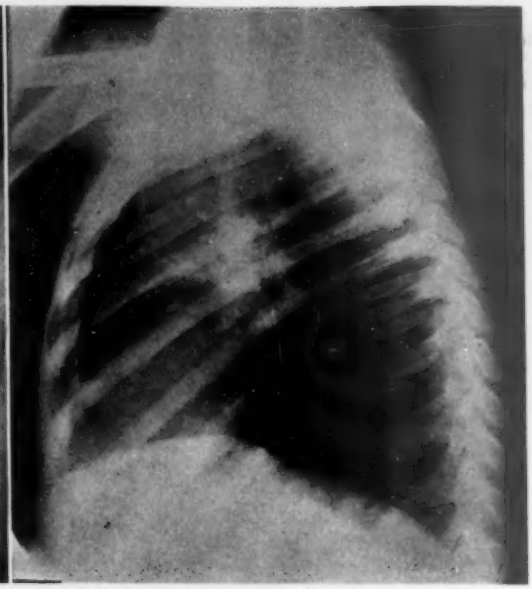

FIG. 6d. Lateral view of same case as Figure 6c showing calcified hilus glands.

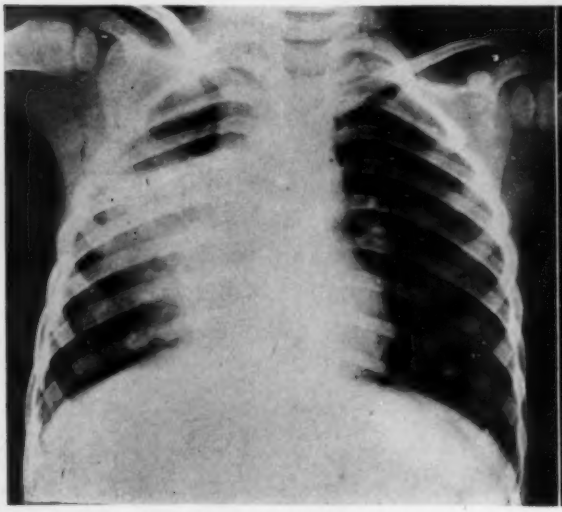

FIG. 7. Hilus tuberculosis right middle lobe in child aged three and one-half years. Autopsy case.

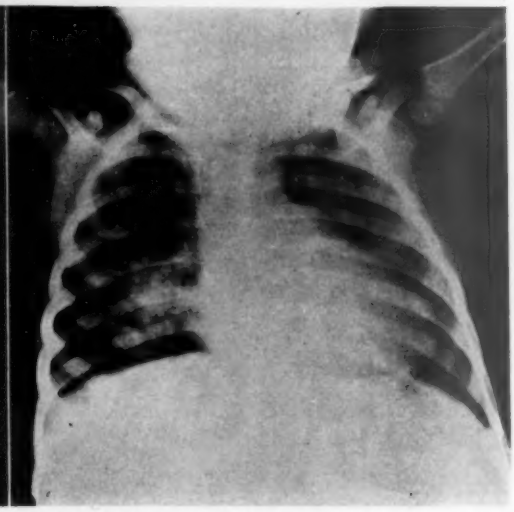

FIG. 8. Recurrent right tuberculous hilus pneumonia in infant aged twenty-three months. Several previous recurrences without residuum. Lesion shown is healing by calcification. Child later succumbed to miliary pulmonary tuberculosis following measles. Autopsy case.

adult life. Four of our autopsy series showed consolidation of the right lower lobe. In 3 instances we observed the development of the infiltration from an inflammatory tuberculous process of the hilus. The roentgenograms offered one point of distinction from those of ordinary basal pneumonia, namely, the sharply penciled linear upper border of the consolidated area (Fig. 9).

In 2 instances we have noted tuberculous pleural effusion in infants, each proven by guinea pig inoculation. In one the fluid was preceded by an extension of an

Fig. 9. Basal tuberculosis in infant aged eleven months. Caseous right paratracheal lymph gland. Autopsy case.

Fig. 11. Adult form of tuberculosis in child aged ten years. Fibrocaseous tuberculosis right upper lobe. Cavity lower portion left upper lobe. Lobular infiltration right lower lobe. Autopsy case.

infiltrative process from the hilus. In the other definite tuberculous bronchial glands were demonstrable after subsidence of the fluid.

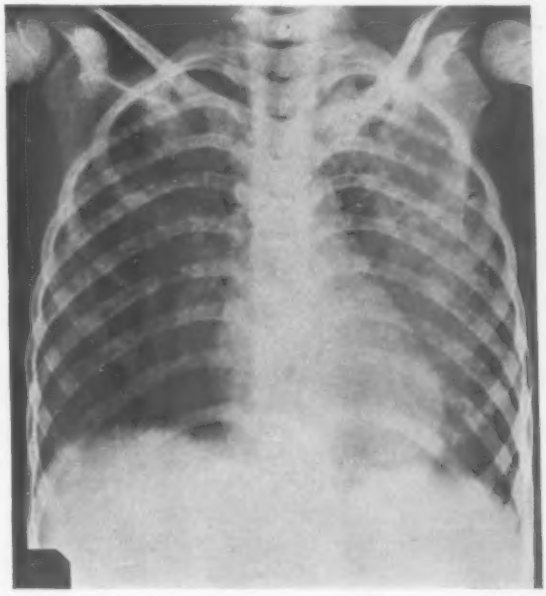

Fig. 10. Conglomerate caseous miliary tuberculosis following measles in child aged seven years. Autopsy case.

MILIARY TUBERCULOSIS

Miliary tuberculosis constituted approximately 25 per cent of the autopsy cases. It may be a terminal phenomenon in any type of tuberculosis. In rare instances it is purely pulmonary, the infiltrations not regular in distribution and there may be caseation or fibrosis. This type occurs secondary to an older lesion in the lung and may develop after the age of infancy. The first symptoms frequently follow closely upon measles or whooping cough.

Our observations lead to the belief that occasionally generalized miliary pulmonary tuberculosis heals, though proof of such phenomenon is difficult to adduce. Such patients do not come to autopsy and sputum is not positive until ulceration into a bronchus has taken place. We are now studying a patient with serial roentgenograms beginning in early infancy. There is history of contact followed by a positive skin reaction. The primary lesion was overlooked. A caseous hilus tuberculosis developed on the right, followed by generalized miliary tubercles of both lungs. For more than a year these lesions have been gradually healing, fever has subsided, and the caseated hilus shadow has shrunken. The patient is gaining weight and is free from any symptoms of the disease.

Miliary tuberculosis of infants most frequently accompanies tuberculous meningitis. The picture is that of a generalized peppering of both lungs with miliary proliferative lesions. There is usually no

evidence of older pulmonary lesions, but there may be telltale hilus glandular shadows. The tubercles may be conglomerate, grouped, and surrounded by an exudative zone (Fig. 10). Perforation of a lung with spontaneous pneumothorax due to softening of a subpleural tubercle has not occurred in our series. The skin reaction in miliary tuberculosis may be negative to small amounts of tuberculin.

ADULT FORMS

As puberty is approached tendency to chronicity becomes manifest. Lesions are more indurated and the apical regions more susceptible. Caseation vies with fibrosis. The result is the multiform picture of fibrocaseous tuberculosis with cavitation, and lobular pneumonia characteristic of the adult (Fig. 11). We have not seen this type of disease prior to the tenth year of age. It is rare before the twelfth year.

ROENTGEN DIAGNOSIS

Except in instances of quiescent hilus gland tuberculosis in children, careful cooperative study of cases by the clinician and roentgenologist should result in few errors. Repeated examinations may be necessary. Important for positive diagnosis among clinical data are history of contact, positive intradermal tuberculin reaction, and the symptoms. The latter differ from those of the adult and consist of fever, anorexia, failure to gain weight, gastrointestinal upset, fretfulness and pallor. Cough is variable. The child is not necessarily poorly nourished. There may be no physical findings. Our mistakes in interpretation have occurred chiefly in those cases in which insufficient time for study was afforded before death. In attempting an independent diagnosis from the roentgenogram we have erred most frequently by mistaking bronchopneumonia for tuberculous infiltration.

FIBRIN BODY IN PNEUMOTHORAX CAVITY*

BY HARRY C. BALLON, M.D.

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THAT fibrin deposits which may develop in a pneumothorax cavity can be recognized roentgenologically was apparently first noted by Fleischner in 1922. He described one case which concerned a patient with right-sided pulmonary tuberculosis who was receiving pneumothorax treatment and who developed a hydropneumothorax. A solitary smooth homogeneous body the size of a small plum was observed to move freely in the exudate whenever the patient was postured. The specific gravity of this body was apparently greater than that of the fluid in which it was immersed. Fleischner states that the presence of small fibrin flakes in a pleural exudate is not of infrequent occurrence and concludes that larger concrement formation should therefore be possible.

Düll in 1925 reported three similar cases. He believed that these fibrin bodies resulted from injury to one of the intercostal arteries during a refill, that blood fibrin had separated out and had formed the so-called "Blutfibrinkugeln"—blood fibrin ball. A pleural exudate which had developed during the course of pneumothorax for right-sided pulmonary tuberculosis was observed in all three but had persisted in only one. A phrenicotomy had also been performed on one patient.

Maendl (1925) also reported two cases. He was of the opinion that the fibrin bodies were but end-products of the exudate which developed during pneumothorax treatment and had nothing to do with trauma to an intercostal vessel. It is to be noted that a hemothorax had undoubtedly developed in one instance during the course of treatment. A thoracoplasty was performed upon this patient but she was not observed further. Both

* From the Chest Service, Washington University School of Medicine and Barnes Hospital, St. Louis, Mo.

patients were free from any signs or symptoms referable to the foreign body, although they were slightly febrile before the fibrin bodies had made their appearance. Fluid was aspirated from the chests of both patients. The fluid in one instance was clear and under a pressure of +12 cm. of water, in the other it was blood tinged. Both were sterile. Maendl states that these are the only patients with such fibrin bodies that he has observed in a series of over 15,000 pneumothorax treatments for pulmonary tuberculosis.

Poindecker (1925) also cites one case in which a fibrin mass was observed in a pneumothorax cavity after the sixth refill when an exudate which had previously formed had become completely resorbed. He thought that the condition of the pleura was an important factor in the development of such a fibrin body ("pneumothorax mouse") and does not accept the theory advanced by Düll.

Stöffel (1926) reported one instance in which a fibrin body was observed in the right thorax after the exudate had disappeared. He was of the opinion that fibrin was deposited on a nucleus of some sort, that this nucleus was possibly furnished by an adhesion which was stretched and torn during a refill; in other words, that fibrin bodies in a pneumothorax cavity develop very much like a calculus. A necropsy was performed upon this patient some considerable time later and the case was again reported by Wischnowitzer. The mass was found to be yellowish in color, resembled cheesy tuberculous material but histologically consisted of pure fibrin. No tubercle bacilli nor blood elements were to be observed in it.

Klinkowstein and Belajewa have added two further cases. Both patients had received pneumothorax treatment for pulmonary tuberculosis. Multiple fibrin bodies were observed in the pneumothorax cavity of one of these patients. These fibrin bodies disappeared in one case. As there was bleeding during some of the refills these authors are inclined to hold the opinion expressed by Düll.

Brandt was able to produce fibrinoplastic bodies in the pleural cavities of dogs by injecting Scharlach R and tar. He concludes that in order that such fibrin or similar bodies may develop a nucleus is necessary, that the nucleus is usually an adhesion and that the fibrin is a product of the exudate. Apparently blood fibrin may also play some part. He notes that the surfaces of the fibrin bodies which are in contact with the lung or diaphragm are rough and may therefore possibly act as irritants.

Flottmann has described fibrin stones which developed in the kidney pelvis in what appears to be a manner similar to that already described. He considers congestion, active bleeding and some alteration in the colloidal state as the most important factors.

CASE REPORT

Female, aged twenty-six, was admitted to the service of Dr. Singer and Dr. Graham on May 13, 1928. This patient had had the usual diseases of childhood. She had had four pregnancies which include one therapeutic abortion. Two children are alive and well, one died at the age of one month from what may have been tuberculosis.

The patient had apparently been in good health until the Fall of 1926, when she began to complain of weakness, of a cough which was associated with rather copious mucopurulent expectoration, occasionally blood streaked, of loss of weight, sweats, constipation and chills. A diagnosis of pulmonary tuberculosis was made and she was admitted to a sanatorium at Mount Vernon where she received pneumothorax treatment. She remained there for nine and one-half months and her condition improved considerably. Her sputum was positive for tubercle bacilli. She was recommended to the Chest Service of Barnes Hospital to consider the advisability of undertaking surgical measures. It was found that pneumothorax treatment was still possible and that it was best to continue it. The patient therefore received refills of 300 to 475 c.c. of air at intervals of ten days to two weeks. The initial pressure was usually −7 to −10, the final pressure always slightly negative.

A roentgenogram of the chest taken on July 25, 1927, revealed the presence of two moderate-sized cavities in the left upper lobe and a few fine apical and basal adhesions. There was no evidence of free fluid. The right chest was relatively clear. The heart was slightly displaced to the right. A subsequent plate taken on May 5, 1928, showed no obvious

change save that the left lung was slightly more compressed. The left diaphragm was somewhat flattened. Following a pneumothorax treatment on May 31, 1928, the patient had a slight reaction with chest pain, fever and a feeling of malaise. She was seen about one week later. There was then the suggestion of a small amount of free fluid in her left chest. An indefinite shadow was noted above the diaphragm but this was interpreted as being part of the left lower lobe. It was not till over three months later that a definite sausage-shaped mass was observed lying above the left dia-

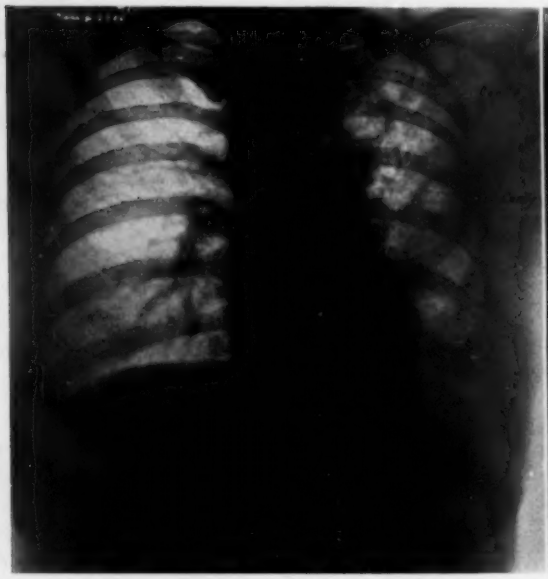

FIG. 1. Roentgenogram taken on July 25, 1927, showing increased detail throughout the entire left chest and two moderate-sized cavities.

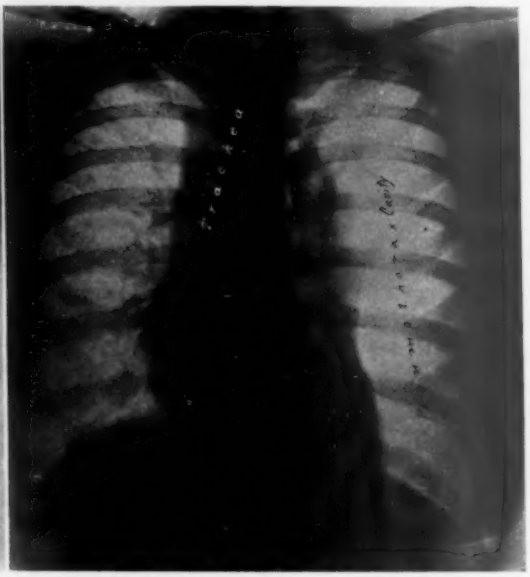

FIG. 2. This plate taken on Oct. 19, 1927, shows a large pneumothorax cavity left. A few apical adhesions and one which corresponds in position with the interlobar fissure are also to be seen. The mediastinal contents have been displaced to the right.

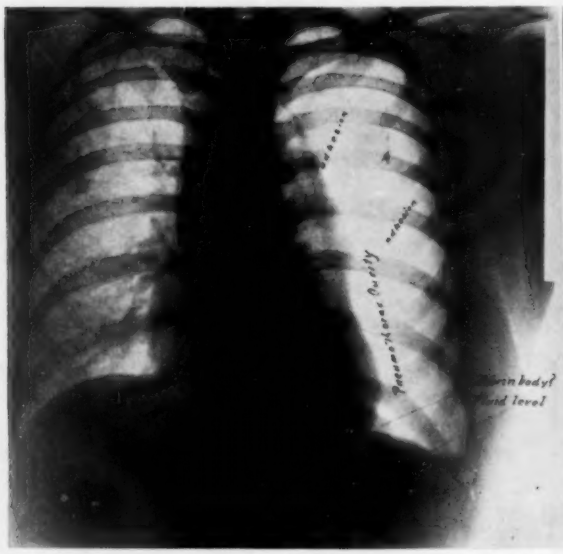

FIG. 3. Roentgenogram taken on June 2, 1928. Note the small shadow protruding from behind the heart shadow, the posterior half of the dome of the left diaphragm and the fluid level.

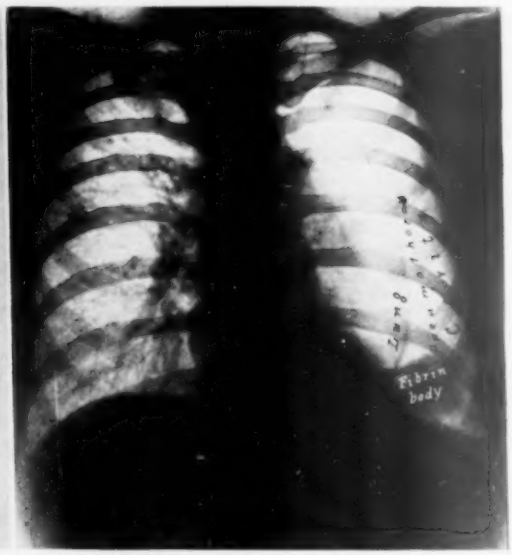

FIG. 4. Roentgenogram taken on Oct. 10, 1928. Note the dense sausage-shaped mass above the diaphragm in the pneumothorax cavity of the left chest.

phragm. There was no free fluid in the left pleural cavity at this time. Dr. Singer performed a lipiodol injection and was able to

Fig. 5. Roentgenogram taken on Oct. 19, 1928. Lipiodol injection performed by Dr. Singer shows that the mass noted in Figure 3 is not directly connected with the lung.

show that this mass was not directly connected with the lung.

This patient has at no time suffered any discomfort from the presence of this foreign body in her pneumothorax cavity.*

This sausage-shaped mass is apparently a fibrin mass which developed during the course of pneumothorax treatment for left-sided pulmonary tuberculosis. A slight reaction was noted after the refill which preceded the appearance of this mass. It can be assumed with a fair degree of certainty that a small amount of fluid had developed in the left chest after the above mentioned pneumothorax treatment. Whether or not an intercostal vessel was injured during the refill it is difficult to tell. Fine basal adhesions had previously been observed.

We are therefore of the opinion, already expressed by others, that this body is a fibrin mass, the product of an exudate which deposited about a nucleus of some sort, likely an adhesion which was torn during the course of a refill. We cannot exclude the possibility that an intercostal vessel may have been injured and that

Fig. 6. Roentgenogram taken on Dec. 11, 1928, in the partial lateral position with the left side up. The fibrin body has been displaced from the diaphragm and is apparently smaller.

blood fibrin may therefore have played some part. It is interesting to note that Voit and his coworkers have shown that fibrin in an acid medium may take up water and swell. Thoracoscopy was not considered indicated in this case.

In the differential diagnosis of this condition the following conditions may be considered: fibrinous pleurisy, encysted empyema, echinococcus cyst, tumor of the lung or chest wall, an atelectatic lobe or a lobe of the lung from the opposite side which has been drawn over, foreign body, broncho-pleural fistula, tumor of the rib, calcification of its pleura or a pendulous fatty pericardium.

SUMMARY

The presence of fibrin bodies, ("Fibrinkugeln" or "Blutfibrinkugeln") in pneumothorax cavities has been noted on ten occasions. An additional observation has

*Since submitting this paper for publication the patient has been observed on several occasions. When last observed on July 25, 1929, the fibrin body was found to be much smaller and only very faintly visible. Its position was unaltered.

been recorded. All cases concern patients with pulmonary tuberculosis who were receiving pneumothorax treatment. A serous or hemorrhagic exudate developed in every instance and preceded the appearance of these fibrin bodies. The exudate was observed to be in the right chest in every instance but one. The fibrin bodies were multiple on two occasions. These fibrin bodies cause no discomfort and usually disappear, but the exudate disappears first. Lipiodol injection will aid in the differential diagnosis of the condition. So, too, by posturing the patient and taking plates in various positions a more accurate diagnosis by exclusion can be made. Thoracoscopy and a lipiodol injection into the pleural cavity could also be carried out if necessary.

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SIGNIFICANCE OF GAS UNDER THE RIGHT DOME OF THE DIAPHRAGM

WITH DISCUSSION OF HEPATOPTOSIS*

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THE roentgenologic finding of gas under the right dome of the diaphragm is always interesting and may be of considerable diagnostic importance. During the last year we have had the opportunity of studying several patients in whom the finding of gas under the right dome of the diaphragm helped to crystallize the opinion justifying subsequent operation. The findings at operation were not always what we anticipated, but were nevertheless, important. It is the object of this presentation to report these cases, and review briefly the conditions which cause gas under the right dome of the diaphragm.

CASE I. G. B. S., white, male, aged sixty-five, was admitted to the University Hospital on the service of Dr. E. L. Eliason, Feb. 21, 1928.

History Present Illness. The patient had had vague gaseous indigestion for years. One week previous to admission he had a sudden cramp-like pain throughout the abdomen which came on three to four hours after a meal and gradually wore off. On the day before admission he had a recurrence of this pain. It was more severe, persistent and localized in the anterior central portion of the abdomen. It produced nausea and a little emesis. Morphia was necessary to relieve the pain. There was no jaundice, diarrhea, constipation or melena.

There were no other symptoms, and no history of venereal disease. The patient had always been strong and very active.

Physical Examination. The patient was a large, well-built, well-nourished male. The head, eyes, ears and nose were negative. The mouth was negative except for moderate pyorrhea. The examination of the chest showed the lungs to be clear. There was slight enlargement of the heart. The rhythm was regular. No murmurs could be heard.

* From the Department of Roentgenology, Hospital of the University of Pennsylvania, Philadelphia.

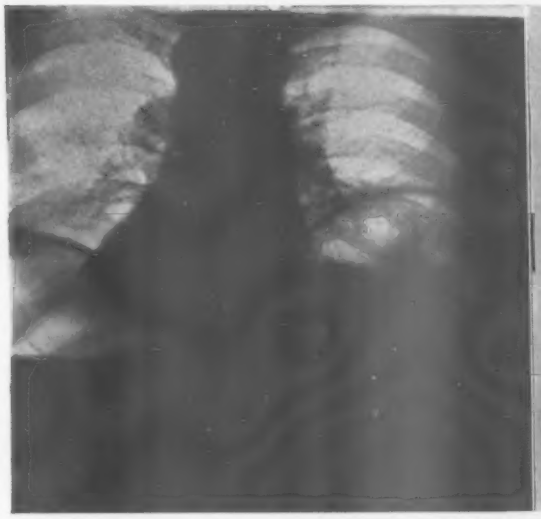

Fig. 1. The anteroposterior view shows gas under both domes of the diaphragm, the gas in the colon being under the right dome. The gas in the stomach is under the left dome. The liver shadow is not seen, the distended colon occupying the space usually occupied by the liver. The haustrations of the colon are clearly seen, which should differentiate this appearance from that seen in a case of ruptured viscus such as is noted in Figure 5. This is a case of hepatoptosis.

Fig. 2. Lateral view of same case as shown in Figure 1 Both domes of the diaphragm are clearly seen.

The abdomen was dome shaped, but soft. There was tenderness over the central portion. No tenderness was noted in the gall-bladder region. The liver was palpable but not enlarged. The peristalsis was normal. The reflexes of the extremities were normal. Blood pressure, 120/88; temperature, 97°F.; pulse, 76; respiration, 22; white blood count, 10,600; hemoglobin, 104 per cent; urine, negative.

Tentative Diagnosis. Chronic cholecystitis, coronary artery disease, tabes or gastric acidotic crises.

Twelve hours later, the pain persisted and the condition was stationary. Pancreatitis, partial obstruction or subacute perforation of peptic ulcer were suggested.

The patient was sent to the roentgen department to be examined for possible air beneath the diaphragm. A preliminary report was positive so exploratory laparotomy was done immediately, partly because of the roentgen findings and partly because of the increase in pain. Extensive fat necrosis of the mesentery and a circumscribed area of pancreatitis in the head of the pancreas was found. The lesion in the pancreas was incised and drained. The liver appeared to be rotated as the left lobe presented and the cavity beneath the right dome of the diaphragm was filled by distended colon.

After operation, the patient's heart fibrillated intermittently and the blood pressure fell to 82/50. The skin became moist and the patient was nauseated and vomited. Digitalis, fluids by skin and bowel and two blood transfusions produced temporary improvement. Then on the sixth postoperative day, the patient gradually became weaker and died.

On the day after operation, the blood sugar was 129 mg. and the urea nitrogen was 29 mg.; on the day of death, the blood sugar was 219 mg. and the urea nitrogen was 120 mg.

The post-mortem examination revealed diffuse fat necrosis throughout the abdomen, the old pancreatitis in the head of the pancreas drained and a fresh hemorrhagic area in the tail of the pancreas. The liver was normal in size (1900 gm.) but was rotated towards the spinal column so that the right lobe could not be felt beneath the right dome of the diaphragm, and the left lobe presented. The colon and small intestine were distended. The ascending and transverse colon beneath the right dome was approximately 8 inches in diameter. The gall-bladder was distended and a large cholesterin stone was found in it (Figs. 1 and 2).

Comment. This patient came in as an emergency patient, suffering with an acute process in the abdomen. A roentgen examination was made and gas was found beneath both domes of the diaphragm. After a wet film reading, a diagnosis was made of gas beneath the right dome of the diaphragm, probably due to a

FIG. 3. Note the gas under the right dome of the diaphragm in a case of hepatoptosis. The haustrations of the colon are clearly seen.

FIG. 4. Same case as in Figure 3, showing the colon filled with barium.

ruptured viscus. It was only after the roentgenograms were dry that the haustrations of the colon were seen and the diagnosis revised. The final roentgen diagnosis was hepatoptosis with interposition of the colon beneath the right dome of the diaphragm. In this case, operation was necessary, and we do not believe that the roentgen diagnosis of ruptured viscus caused an unnecessary laparotomy, but it does illustrate how an anomalous condition may closely simulate a serious surgical condition.

Discussion of Hepatoptosis. Hepatoptosis or floating liver is a condition in which the liver is completely dislocated from its usual position under the diaphragm; it does not include cases of floating liver in which a portion of the organ remains in its normal position. Heister,[14] in 1754, was the first to publish a description of the post-mortem appearance of the abdominal organs in a case of hepatic displacement. The case which he reported was very much like the one detailed above. Since Heister's observation, a number of excellent treatises have been published on this subject. The total cases up to 1905, according to Clarke and Dolley,[3] were 128. In most of the patients the physical findings have been definite enough to diagnose the condition before operation or autopsy. Since the advent of roentgenology, the condition should be found with greater ease and frequency. We do not know how often the condition occurs, but it is found frequently enough so that one should be aware that such an anomaly does exist, and if it is observed in a patient suffering from an acute process in the abdomen, one is confronted with the problem of differential diagnosis that is not altogether easy.

Roentgenological Appearances. There is gas under the right dome of the diaphragm. The haustrations of the colon can usually be seen in either the anteroposterior or lateral views. If there is any doubt as to the diagnosis on the plain roentgenograms, a barium enema or barium meal will materially aid in the diagnosis (Figs. 3 and 4).

CASE II. W. G., white, male, aged twenty-three. The patient was admitted to the Howard Hospital on the service of Dr. E. L. Eliason, Feb. 18, 1929.

Chief Complaint. Acute abdominal pain.

History Present Illness. The patient was riding on a bread wagon when he was seized with unbearable abdominal pain. He was brought to the hospital in this condition. He stated that he had never had indigestion. That morning he had a liverwurst sandwich and a glass of gin.

Past Medical History. Negative.

Physical Examination. The patient was a well-developed man, complaining of acute abdominal pain. His entire examination was negative except the abdomen which showed extreme muscular rigidity. It was impossible to palpate it because of soreness.

Tentative Diagnosis. Ruptured ulcer.

A roentgenologic examination by Dr. Donald Zulick confirmed the diagnosis of ruptured viscus (see Fig. 5).

Operation. An upper right rectus paramedian incision was made. When the abdomen was opened a pint of free gastric contents was removed. A small perforation was found on the anterior surface of the duodenum about ½ inch from the pylorus.

Fig. 5. Free gas is present under both domes of the diaphragm. This appearance should be easily differentiated from the appearance found in hepatoptosis.

Comment. In this case the clinical and roentgenologic diagnoses were quite evident. The roentgenogram shows a collection of gas under each dome of the diaphragm. The patient made an uneventful recovery.

Case III. M. W., white, female, aged forty, was admitted to the University Hospital on the service of Dr. E. L. Eliason, Jan. 15, 1929.

Chief Complaint. Indigestion.

History Present Illness. The patient had complained of indigestion for four or five years. She had eructations of gas and occasional slight pains, which were relieved by vomiting.

Past Medical History. Negative.

Physical Examination. There were no findings to suggest an acute process in the abdomen, which was soft and flabby, and there were no palpable masses.

The roentgen examination of the gastrointestinal tract showed the following:

The stomach showed a complete six hour residue, probably due to a pyloric or duodenal ulcer. The pyloric end of the stomach was fixed. There was some gas under the right dome of the diaphragm which suggested that there had been a perforation of the ulcer.

Operation. A right rectus incision was made. The peritoneum was opened and the stomach was so distended with contents that it had to be opened and aspirated. This was extremely difficult because the contents clogged the aspirator. The opening in the stomach was then closed and oversewed with a piece of omentum.

The pylorus was then explored and a large callous ulcer was found about 1 cm. distal to it. At the same time a dense mass of adhesions was found between what appeared to be the gall-bladder and the second portion of the duodenum. After careful dissection this proved to be a perforation of the gall-bladder with a stone in the adhesions. This perforation had not completely ruptured into the duodenum.

The common duct was then isolated; it was enormously dilated and at first it was mistaken for the gall-bladder. Considerable bleeding was found in the gall-bladder, which had shrivelled to about the size of a little finger. Several stones were palpated in the common duct. The common duct was opened and three or four stones removed. Bile spurted from the common duct; a cannula was inserted in both directions and it was found to be patent. The common duct was closed by interrupted sutures of #00 chromic catgut. The duodenal ulcer was then oversewed and a posterior gastrojejunostomy done according to the usual no-loop, antiperistaltic method of Mayo. A tube was placed in the gall-bladder and a split rubber tube was placed in the opening of the common duct. The abdomen was closed in the usual manner.

The only explanation for the gas found beneath the right dome of the diaphragm by the roentgen examination was the apparent perforation of the gall-bladder. There were no adhesions over the dome of the liver.

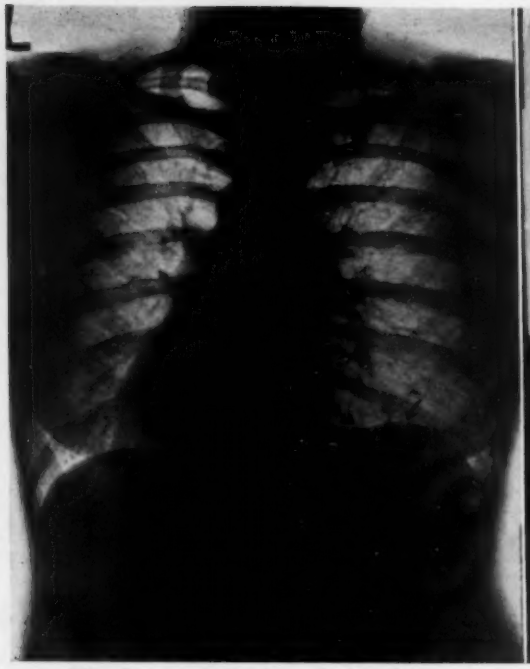

FIG. 6. The first examination of the chest, patient having been referred for an examination of the lungs for tuberculosis. The lungs are negative, but there is a small collection of gas under the right dome of the diaphragm that suggested a possible ruptured viscus. This was easily discernible on the roentgenogram though it shows very poorly on the illustration.

FIG. 7. Same case as shown in Figure 6, the film being made six hours after first opaque meal. There is a complete six hour retention and an almost complete retention at eighteen hours. No gas is seen under the dome of the diaphragm in this roentgenogram.

Comment. This patient was first sent to us for examination of the chest by the outpatient department, with findings suggestive of tuberculosis of the lungs. The roentgen examination of the lungs was negative, but there was a small collection of gas below the right dome of the diaphragm which was regarded as evidence of a ruptured viscus. We sent an ambulance for the patient who was much surprised and did not wish to come to the hospital. She was thoroughly examined after coming to the hospital, and physical findings and clinical symptoms of a ruptured viscus were totally absent. Except for the belching, occasional pain with vomiting and history of indigestion there was nothing to suggest a surgical abdomen. A roentgen examination of the gastrointestinal tract relieved our minds as the question of an error in marking the roentgenograms had already been raised. But when we found that the patient had a complete six hour residue with gas under the right dome of the diaphragm, it was quite evident that she had a surgical condition that was giving few or no symptoms (see Figs. 6 and 7).

DISCUSSION OF FREE GAS UNDER THE RIGHT DOME OF THE DIAPHRAGM AS EVIDENCE OF A RUPTURED VISCUS

When we began the study of this subject we became interested in who was the first to roentgenologically demonstrate gas under the right dome of the diaphragm. Clinicians, for years, have recognized the tympanitic note in the right upper quadrant in typhoid fever as evidence of a ruptured viscus, but very little effort has been made to indentify the roentgenologist who first recorded this diagnostic sign of a ruptured viscus. Goodman[10] states that Kelling[16] should be given credit for first suggesting oxygen as an aid in roentgen diagnosis. Kelling[16,17] used oxygen experimentally and also inflated the abdomen so that he could observe the organs with a cystoscope but he never mentioned the use of oxygen as an aid to

FIG. 8. The anteroposterior view of a case of subphrenic abscess with gas and fluid level. This is a typical appearance where there is a large abscess containing gas.

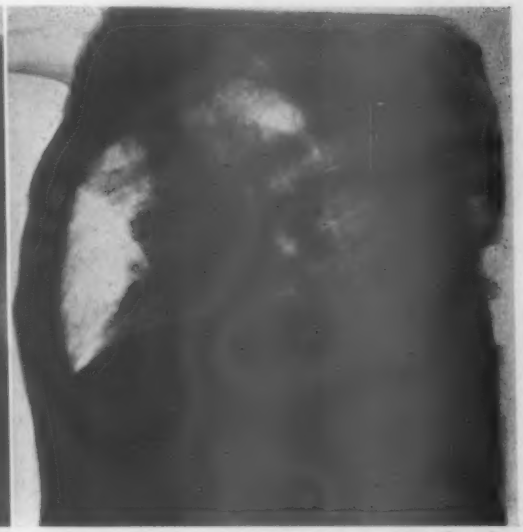

FIG. 9. Lateral view of same case as in Figure 8, showing the size of the abscess cavity with the gas under the right dome of the diaphragm.

roentgen diagnosis so far as we could determine. Alvarez[1] and Haenisch[11] give Lorey[20] credit for being the first to suggest the introduction of air into the abdomen as an aid to roentgen diagnosis. Lorey was able to demonstrate gas in the abdomen following paracentesis of an ascites and recognized the possibilities of diagnosis. Weber[33] did some experimental work with rabbits, demonstrating the value of pneumoperitoneum. Jacobaeus[15] Meyer-Betz,[22] Goetze,[8,9] Rautenberg,[29] and Stewart,[32] did a great deal of work on pneumoperitoneum but in none of these papers can we find any mention of the origin of pneumoperitoneum so far as a ruptured viscus is concerned.

Moynihan[24] states that Bueqoy records a case of ulcer that had a dull tumidity which later became tympanitic on the right side. In 1901, Moynihan[25] in an article on perforated duodenal ulcer called attention to the frequency of symptoms on the right side "because contents of the duodenum trickles downward to the upper surface of the transverse mesocolon to the right of the hillock which is formed by the fitting in of the transverse colon to the greater curvature of the stomach. It is then directed downwards to the hepatic flexure and to the outer side of the ascending colon to fill the 'kidney pouch' described by Rutherford Morrison." "The fluid,[26] escaping from the duodenum, is from the first prevented from going to the left by the peritoneal reflection of the great omentum from the duodenum and the stomach."

Heidenhain,[12] Heineke,[13] Reichardt,[30] and Spater,[31] are referred to by Kelling simply because of experiments and methods used in checking abdominal hemorrhage, no mention being made of the aid of roentgen examination.

In 1916, Lenk[19] reported the roentgen finding in soldiers who had abdominal wounds, and this seems to be the first report of cases in which the roentgen examination was demonstrated to be of value in diagnosing perforation of an abdominal viscus. Shortly after this, LeWald studied a case that was reported by Martin[21] in which gas was present under the right dome of the diaphragm from a ruptured duodenal ulcer. Since that time, Kellogg,[18] Case,[2] Dahm,[5] Dandy,[6] Copher,[4] and possibly others, have reported cases of spontaneous pneumoperitoneum following ruptured ulcers either peptic or typhoid.

Roentgenologic Appearance. The right dome of the diaphragm lies adjacent to the upper surface of the liver. Gas which has forced its way between the dome of

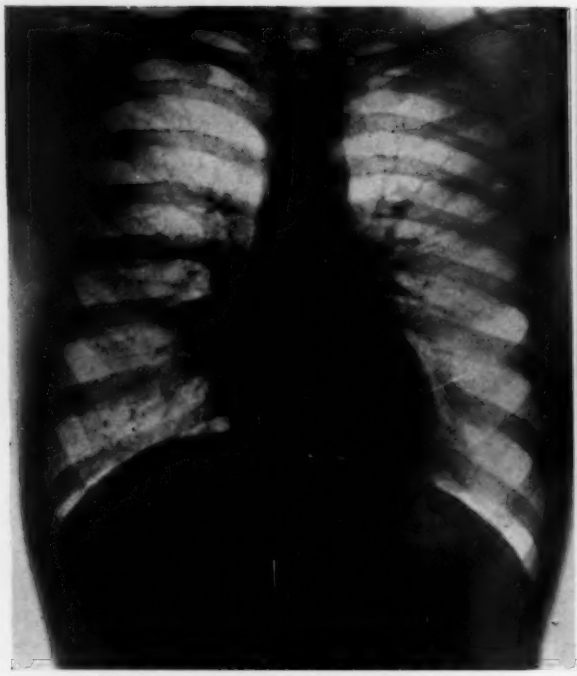

FIG. 10. R. B. J. A case of true dextrocardia. Note the globule of gas beneath the right dome of the diaphragm. This would have to be differentiated from a liver abscess with contained air and a fluid level. An opaque meal is all that is necessary to differentiate the two conditions.

FIG. 11. Lateral view of the same case as shown in Figure 10. The gas and fluid level can be seen under the dome of the diaphragm.

the diaphragm and the liver assumes a curved line following the under surface of the diaphragm, the concavity of the line being downward. This line may be seen in the lateral and anteroposterior views, particularly in the lateral.

Differential Diagnosis. Subphrenic or subdiaphragmatic abscess may contain gas which is easily demonstrable. It is more frequently located under the right dome of the diaphragm. Moore[23] Pancoast and Fussell,[27] Pancoast[28] and Eliason,[7] have described these appearances. There is usually a collection of gas above a fluid level which has the shape of a segment of a circle seen usually in both views. There is a definite wave effect of the fluid after shaking the patient. It is therefore easy to differentiate this appearance from that of gas under the dome from a ruptured viscus or from a case of hepatoptosis when the haustration of the colon is easily demonstrable (see Figs. 8 and 9).

Transposition of the viscera with the stomach on the right side, and with a gas and fluid level in the stomach may closely simulate the appearance of a subdiaphragmatic abscess, but does not present the appearance of either hepatoptosis or gas from a ruptured viscus. A roentgenoscopic examination with the heart on the right side and the administration of an opaque meal will aid in identifying the condition (see Figs. 10 and 11).

Gas under the dome of the diaphragm following an abdominal operation will exactly simulate the appearance found in a ruptured viscus. Here the history of previous operation is the only clue as to the correct diagnosis. At present we are making examinations of the chest before and after operation on every patient on the surgical service of Dr. George P. Muller, and gas is demonstrable under the right dome of diaphragm in 60 per cent of the cases, twenty-four hours and longer after operation (Figs. 12 and 13).

Technique of Examination. In any patient suspected of having a ruptured viscus, the examination of the diaphragm should be made in the erect posture. Two views should be made, one antero-

FIG. 12. Anteroposterior view which shows collection of air under each dome of the diaphragm following abdominal operation.

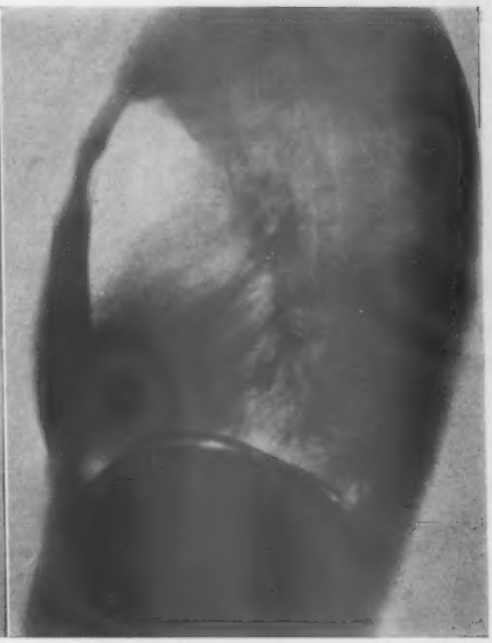

FIG. 13. Lateral view, same case as in Figure 12, showing the air between the liver and the dome of the diaphragm.

FIG. 14. Anteroposterior view of the chest in the semi-erect posture. No gas can be seen under the dome of the diaphragm.

FIG. 15. Lateral view of the same case as Figure 14, in the same position, definitely showing the gas under the dome of the diaphragm anteriorly, therefore being obscured by the liver in the anteroposterior view. This is gas under the dome of the diaphragm following operation.

posterior and one lateral with the film on the right side of the patient, as the right side is more frequently the location of free gas in the abdomen. Of the two views, the lateral view is more important. A small amount of gas might be obscured by the dome of the liver in the antero-posterior view, but never in the lateral. (see Figs. 14 and 15). We do not believe that it will be too much of a shock for any patient to sit up or be supported in the erect posture in bed for the necessary films. If the patient must be examined in the recumbent posture, the lateral view is the most important.

SUMMARY

1. Two cases of hepatoptosis are reported.

2. Two cases of ruptured viscus are reported.

3. A brief history of the roentgenologic aid from the presence of free gas in the abdomen is given.

4. There is a discussion of the differential diagnosis of conditions causing gas under the right dome of the diaphragm, including hepatoptosis, gas from ruptured viscus, transposition of viscera, subphrenic abscess and free gas following operation.

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ROENTGENOLOGIC STUDY OF THE COLON IN A CHILD WITH A SPINAL CORD LESION

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THIS case is presented because it is in itself unusual—I have not succeeded in finding its duplicate in the literature—but more particularly because any evidence no matter how slight, bearing on the interesting but incompletely solved problems of the interrelation of innervation and muscular activity in the intestine in man is desirable for record.

That portion of neurological literature dealing with lesions of the spinal cord speaks frequently of the association of constipation or stasis, but we are almost never told what kind of stasis, such as proximal colonic stasis, or rectal stasis (dyschezia); nor is consideration apparently given to its mode of production. We meet often also the feature of incontinence, in advanced cord lesions, and at times the gaping sphincter. But no interest seems to have been aroused in the actual gastrointestinal findings, and outside of the unrewarding researches into gastric and colonic crises in tabes, cord cases do not seem to have been subject to roentgenologic study of the digestive tract. Through the courtesy of Dr. Charles W. Schwartz I have had access to the records of the Neurological Institute in New York, and have personally questioned many physicians connected with other institutions or in private neurological work, and have found no record, there or in the literature, of roentgen examinations of the colon in cord cases.[1] The extensive work on colonic stasis in the neuroses and psychoneuroses is of course irrelevant to the present study.

REPORT OF CASE

History and Physical Examination. Paul S., aged six, entered the children's service of the Woman's Hospital, Philadelphia, because of obstinate constipation and lesions similar to bed sores on the buttocks. For some months (parent vague as to exact duration) the child had been unable to have a bowel movement except by enema, two or three enemas often being necessary. There was also a history of some incontinence, chiefly in the daytime, which with poor hygienic conditions at home accounted for the sore buttocks.

One and one-half years ago patient had anterior poliomyelitis, with brief paralysis, affecting, according to the mother, "the left arm and chest." Breast fed for one year. Walked at one and one-half years. Had had measles, mumps and chicken pox. There were 3 other children in the family, all alive and well. (No note on miscarriages.)

The head was large, the eyes deviated to the right, the teeth were poor. The tonsils had been removed, but there was considerable adenoid tissue present. There were palpable cervical, axillary and inguinal nodes. Examination of the heart, lungs, and abdomen was negative. Weight, 39½ pounds.

Blood Wassermann, first examination, 2+ (cholesterin); second examination, 3+. Von Pirquet test negative.

Neurological Examination. Eyes deviated to right. Humeri and femora short. Muscles firm, no atrophy. No deformity of spine.

Reflexes: biceps and triceps present; patellar, tendo Achillis, cremasteric, absent. Babinski plus on right.

The bladder was distended (paralysis or anesthesia of the walls).

Anal sphincter relaxed. Sensation around anus impaired, more markedly on left.

Provisional neurologic diagnosis: Some disturbance of the sacrococcygeal region. Lesion of conus terminalis?

Roentgenological Examination of Gastrointestinal Tract. Stomach normal in respect to size, position, mobility, tone and peristalsis. Bulbus duodeni visualized and normal.

At six hours, the head of the barium column is in the ascending colon, the tail of the column in the cecum. The ileum is empty.

At twenty-four hours, the head of the column is in right transverse colon, tail in cecum. Appendix not visualized. Cecum and ascending colon not dilated. Good tone.

At forty-eight hours, the head of column in upper descending colon, tail just proximal to hepatic flexure.

On the fourth day, the barium column had advanced 4 inches farther in the descending colon. Haustrations are normal, muscle tone is good. On the fifth day there is an advance of

[1] Except for the brief statement of Hurst, as quoted.

about 3 inches. By the eighth day the head of the column is in the pelvic colon and the tail has reached the splenic flexure. The effect of drying out of retained feces is now apparent, in the rounded scybalous masses. The tenth day shows the same regular progress, 5 or 6 inches farther in the pelvic colon, and by the twelfth day the barium has reached the rectum. Roentgenoscopic examination on the fourteenth day shows the rectum filled and a small amount of barium in the pelvic colon.

Diagnosis: Colonic stasis.

FIG. 1. Six hours p.c.

FIG. 2. Twenty-four hours p.c.

DISCUSSION

It will be seen that the two ends of the barium column progress at about the same rate. There is no piling up anywhere, no cecal stasis, no rectal dyschezia. There is a contrasting and marked hypermotility of the small intestine, though the emptying time of the stomach is unknown. Although the motility of the proximal colon is retarded (see Figs. 2 and 3), it is not proportional to the excessive retardation from the splenic flexure on, the time being forty-eight hours to the splenic flexure and ten days from the splenic flexure to the rectum.

It is interesting to note that the child showed no evidence of intoxication from retained feces—no headache, loss of appetite, sleeplessness, no meteorism, no pain nor soreness in the abdomen. This is in line with Barclay, who quotes cases of women perfectly healthy who defecate two or three times a month. Gant speaks of a case which emptied the bowels once in six weeks, with enormous soapsuds injections. But none of these cases had any similarity of etiology to the present one. Barclay says farther:

"My experience in the study of these cases (marked colonic stasis) is that there are two, and only two, real seats of stagnation in the large intestine, namely the caecum and the rectum. Rectal stagnation (dyschezia) is really a fault of defecation rather than true constipation. But in constipation proper, the delay is nearly always in the caecum and ascending colon, and these portions remain filled for days at a time, in spite of the fact that some of the contents may have moved on to various parts of the colon; in other words, there is a defect of the 'mass movement,' a defect not of one part of the colon but of the mechanism."

This quotation from Barclay is offered here because, in the present case there is believed, as will be shown below, to be a defect in the "mass movement," and hence in the mechanism as a whole, but with strikingly different results.

Comment on Diagnostic and Neurologic Aspect. The incomplete neurological examination, and the coexistence of a 3+ Wassermann reaction and a definite history of poliomyelitis, make a clear-cut diagnosis impossible, and render even diagnostic speculation uncertain and insecure. On the basis of the roentgen findings, a more thorough neurological examination was requested, but at about this time the child's sore buttocks had healed up and he was taken home against advice. The parents were Polish people of a poor and ignorant type, spoke little English, and refused to return the child to the hospital, though several times importuned by the social worker.

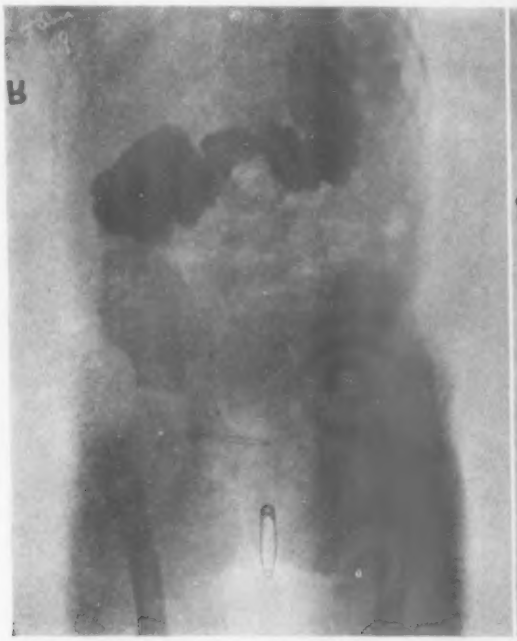

Fig. 3. Forty-eight hours p.c.

Fig. 4. Four days p.c.

However, utilizing what we have, the lost reflexes, both tendon and superficial, and the sensory impairment noted in bladder and anal region, would indicate involvement of the lumbosacral cord extending at least as high as the first lumbar. The changes of the humeri and femora (shortening) are due to poliomyelitis, with the restoration of normal reflexes in upper extremities representing recovery from the disease in this region. Whether the present lesion in the lower cord is due to poliomyelitis, or to lues, or both, whether there is, or was, an even more extensive lesion of either, higher up, is insoluble with the data at hand. The unexplained deviation of the eyes to the right would indicate a cerebral lesion or pyramidal tract pathology. The Babinski sign is occasionally present in poliomyelitis, as noted in Wickman's monograph (p. 49).

While the age of the patient is against spinal lues, Sachs has this to say in favor of this diagnosis:

> Under "syphilis," p. 272.—"In cases of spinal paralysis the morbid process invades the cross section of the cord partially and slowly. The disease involves a very large portion, if not the entire spinal cord, yet affects each single segment relatively little. (Differing from myelitis, where there is intense involvement of entire cross section of the cord.) . . . Rectal and bladder disturbances are common."
>
> As against poliomyelitis, he says, p. 147,—"The entire absence of bladder and rectal symptoms (in anterior poliomyelitis) is of importance; especially under conditions in which it would be important to differentiate between inflammation of the anterior horns and a general myelitis." And further, on poliomyelitis (p. 142), "With the exception of

the hyperesthesia which sometimes accompanies the onset of the disease, the entire absence of disturbances of sensation should be noted."

reported of pure spinal lues in congenital syphilis. The spinal cord usually becomes involved in the form of disease of the arteries and veins, circumscribed and diffuse infiltrat-

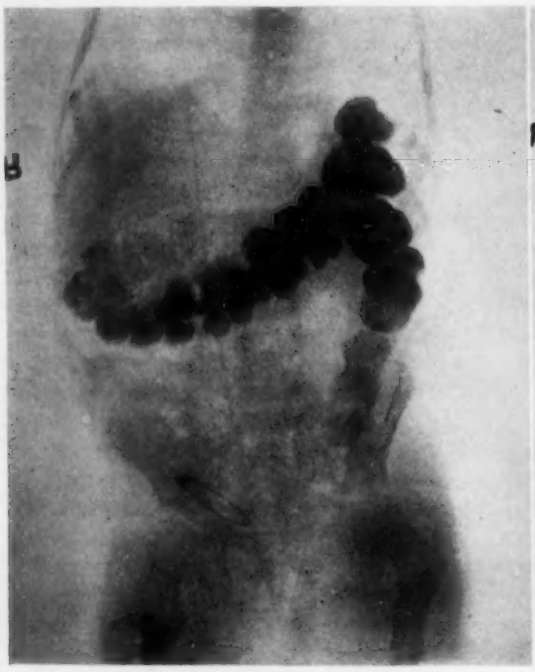

FIG. 5. Five days p.c.

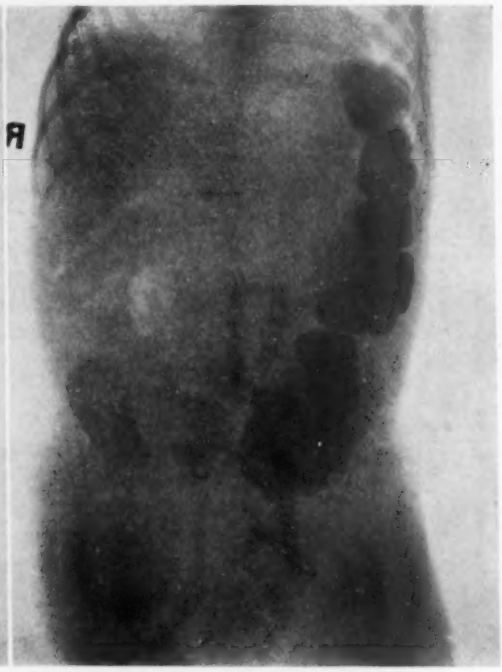

FIG. 6. Eight days p.c.

Ruhräh, on the other hand, presents a different point of view. Under a heading "sensory disturbances" he says (p. 129):

"These have not been studied either, except by comparatively few observers, and not with any great degree of thoroughness. Various paresthesias have been described, and older children and adults sometimes complain of numbness. Wickman relates a case in which there was diminution of the pain sense from the hips down and paresthesia of both legs. Other cases have been described in which there was complete anesthesia, and loss of electric reaction has been noted. We are so accustomed to thinking of poliomyelitis as a disease affecting the motor part of the nervous system that in spite of the mass of evidence to the contrary the sensory side of the nervous system has been very largely neglected."

A comment from Nonne contributes still another point of view to this diagnostic pot pourri.

"I have never seen in my own experience, nor have I ever found in the literature, a case ing gummatous tumors, meningitis, and root neuritis."

Physiological Considerations.

Innervation of Colon, Rectum, and External Sphincter.

Alvarez offers a summary of his own work and that of other physiologists, from which I shall quote in condensed form:

"In the first place, it is improbable that the vagus supplies any part of the large intestine.

"The main supply comes from the anterior roots of the sacral nerves through connector neurones which join together to form on each side the nervus erigens (pelvic nerve). This connects with pelvic plexuses in the walls of bladder and rectum [parasympathetic system].

"Corresponding to the sympathetic supply of the small bowel there are the hypogastric nerves which run from the inferior mesenteric ganglia to connect with the pelvic plexuses. The inferior mesenteric ganglia are connected to the anterior roots of the lower lumbar cord by a number of fibres which by some are called the inferior splanchnics, but which to avoid

confusion should better be called the spinal rami of the inferior mesenteric ganglia.

"Some of the sensory nerves in the colon appear to run with the sympathetic fibres

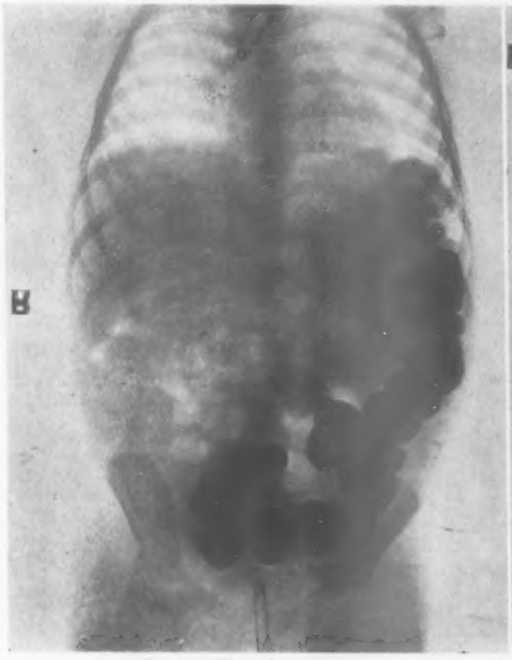

Fig. 7. Ten days p.c.

Fig. 8. Twelve days p.c.

much as they do in the upper abdomen, and many others reach the cord through the pelvic nerve, one third of which is made up of afferent fibres.

"In man the most important nerve centers for the sphincters are apparently in the third and fourth sacral segments of the cord, but some tonic influences seem to come also from the brain . . . There seems also to be a center in the medulla for defecation close to the center for vomiting (Hatcher)."

The actual act of defecation is a complicated one, involving both voluntary and involuntary muscles, including those of the anterior abdominal wall, diaphragm, internal and external sphincter, levator ani, other voluntary muscles about the perineum, and finally peristaltic contractions of the whole colon (as observed by Hurst).

From the roentgen study of the case, it is believed that the fault is at the distal end of the tube, at the relaxed external sphincter and the apparently relaxed internal sphincter. There is a suggestion of "patulous recto-sigmoid," as described by Mills and Soper, which they consider "the result of divulsion through rectal fecal retention." (Hurst says that nothing resembling a true sphincter exists at this point.) The tone of the bowel is good throughout, with, as noted above, no cecal stasis, no dyschezia. The haustrations are normal. Palpatory manipulation under the roentgenoscope reveals no kinks, no adhesions, no abnormal points of fixation. There is no sign of the generalized dilatation or atony producing obstruction which is of nervous, non-mechanical origin, described by Kantor and others as neural ileus. There is no lack of vis a tergo. In fact the gradient in the small intestine is markedly steepened. There is no abnormality of function apparent at the ileocecal valve. Whatever the diagnosis then, we are dealing with some lesion involving the sacral cord, and producing relaxed sphincters and loss of sensation around the anus.

The effect of such cord lesions on the lower digestive tract has been discussed by a few authors. Bálint and Benedict present 6 cases of lesions of the conus

terminalis or cauda equina, accompanied by relaxed sphincters and loss of sensation, with constipation. The diagnoses here were traumatic myelitis, 3; myelitis, one; primary root neuritis of cauda equine, one, and a caudal lesion from pressure of a non-spinal tumor, aneurysmal dilatation, one. In these was frequently described "no direct call to stool," "no sensation from act of defecation." The majority were not incontinent, but all were constipated. It is regrettable that no roentgen studies were made of the colon, as it seems probable that findings similar to the present case might have been secured.

Stookey, in a study of bladder and rectal disturbances in spinal cord tumors, found constipation present in almost every case. He reports rectal disturbances in 83 per cent of conal and cauda equinal tumors, though he observes that "there is no constant relationship between levels in the cord and degrees of sphincteric disturbance; and rectal weakness was seen sometimes even with tumors in the thoracic region." He made a further observation, interesting in connection with the present case, that there seemed to be less relation between bladder and rectal incontinence and the presence of marked motor changes, than between bladder and rectal incontinence and sensory changes.

Hurst makes the following statement, with which my case is at variance:

"I have found with the X-Rays that the severe constipation which often occurs in organic diseases of the central nervous system involving the lower end of the spinal cord or the tracts which connect it with the brain, is due to dyschezia, as the rate of passage through the colon is unaltered."

He did not describe specific cases, however, with detailed neurologic or roentgenologic colon findings.

Experiments on animals give results interesting and relevant to the present case, though as to be expected, not always consistent with one another. Several of these are collected by Alvarez, from whom I shall quote, as follows:

"Merzbacher cut the sensory roots of the three sacral nerves in the dog and produced anesthesia of the anus and part of the rectum. At first the anus gaped, but after three weeks it regained enough of its tone to stay closed. These animals were badly off because there was no call to defecation, and feces stagnated and dried out. Finally enough material would accumulate in the colon so that a part of the plug in the lower end could be pushed out; the rectum remained passive, and the dog made no attempt to defecate.

"Goltz and Ewald, working on dogs, transected the cord at various levels and also destroyed it from the seventh cervical segment downward.

"Immediately after destruction of the lumbar and sacral cord the anus was relaxed and gaping, and in some animals for several days there was diarrhea, but gradually this cleared up and the digestive processes and defecation returned to normal. The condition of the animals was better after transections than after excisions, because when the lower end of the cord was left it soon regained some of its ability to mediate reflexes."

A suggestive point arises here, as to the apparent variance between this finding, and my case and the experiments of Merzbacher. In my case, as poorly localized as the spinal involvement is, due to inadequate neurologic examination, it is more extensive than, and not similar to, a simple, clean-cut transection, with subsequent establishment of limited reflexes below. And in Merzbacher's experiments, by cutting the roots the reflex arc involved in the process of defecation was completely broken.

As Alvarez observes:

"The most severe disturbances of defecation seem to be produced by destruction of the afferent nerves from the anal region (or, may one add, their neurons in the cord), because when an animal or a man cannot take cognizance of fecal material in the rectum, there is nothing to start the chain of reflexes that bring about defecation."

This would seem to be the fundamental explanation of the type of stasis found in the present case. Because of lack of sensation in the rectum there is no sense of fullness to remind one of a need for defecation. With the distal end of the gut partly filled, there is no excitant to

mass movements. The material moves slowly on, probably by local autonomous action of the bowel musculature. There is no sudden entry of a large amount of material into the rectum, which Hurst considers the source of the desire to defecate, although as above noted, this could probably not be felt, even if it occurred. It is a vicious circle.

The large number of cases which were not incontinent, even with gaping sphincter and loss of rectal and anal sensation (Bálint and Benedict, and Stookey), were, it must be remembered, adults. The control of the will, the exercise of the intelligence, the observation of other sensations such as sacral weight or pressure and the association of them to produce a "warning to stool" (Bálint and Benedict) are all attributes or accomplishments of adults. It will be interesting to see whether this child of six, if he survives, learns to control his incontinence as he grows older.

SUMMARY

A case is presented of a child, aged six, with a 3+ Wassermann reaction and a history of poliomyelitis, having a spinal cord lesion unsatisfactorily localized but known to include to some degree the lumbosacral segments, with involvement of both motor and sensory fasciculi within the cord. He has a gaping sphincter, with loss of sensation in the rectum and around the anus. There is some incontinence. A gastrointestinal study by the roentgen ray shows a marked colonic stasis, a barium meal requiring twelve days to reach the rectum, and longer to be completely expelled. The retardation is chiefly in the distal colon. There is no localized dilatation or atony of the large gut, no cecal stasis, no dyschezia. The tone of the entire colon is good, the haustra are normal. The fault is believed to be chiefly a sensory impairment at the anal end of the tube, resulting in a complete absence of mass movement.

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A METHOD FOR THE DIRECT VISUALIZATION OF LESIONS IN THE SMALL INTESTINES

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SINCE the introduction by Cannon of an opaque medium for the study of the gastrointestinal tract of dogs, a steady advance in the localization of lesions in the human gastrointestinal system has been made. Today, a fairly complete knowledge of the stomach and duodenum in its normal and pathological state has been attained by the study with a barium meal. While the interpretation of lesions of the large bowel has been greatly aided by use of the barium enema, the localization and visualization of lesions of the small bowel has offered great difficulties due to the irregularities of its action, its motility and the flaky distribution that the menstruum assumes in this portion of the gastrointestinal tract.

As an aid in overcoming these difficulties, the following method has been adopted in our studies of the small bowel. It is simple and free from any untoward symptoms. A duodenal tube is swallowed by the patient and allowed to pass into the duodenum in the same manner as in the study of gall-bladder and duodenum, the latter studies having been made by Abrams and Jarvis, Buckstein, Crouse, Einhorn and others. The mixture of barium, acacia and water is then permitted to flow slowly under gravity through the tube. Under the roentgenoscopic screen, the rate of the flow of the menstruum can be completely controlled. The motility of the advancing column, the peristalsis, the contour of the intestinal coils, their freedom under the palpating hand, spasticities, deformities or other abnormalities can be accurately observed. Plates can be made at any time during the examination whenever the operator deems it advisable. The entire small bowel can be studied in less than one-half hour.

The data obtained with this examination, when taken in conjunction with the clinical data of a given case, materially aid in a diagnosis.

The following case is reported to illustrate the value of the method described:

CASE REPORT

Male, aged forty-two, an insurance agent, was admitted to the Sanatorium Aug. 31, 1927, with a diagnosis of tuberculous enterocolitis.

Past History. In 1922 there were attacks of indigestion with foul gaseous eructations and cramps in both upper quadrants. The symptoms appeared one hour after meals. Diarrhea occurred at irregular intervals. The pulse was rapid, rectal temperature ranged from 99 to 102°F. There was definite tenderness in the right lower quadrant in June and November, 1922, and in June, 1923. There was no history of hematemesis or of blood in the stools.

He improved under treatment (dietetic and hygienic regimen) and was relatively free from symptoms until February, 1927. At this time there was a recurrence of pain in the right lower quadrant, he complained of a lack of endurance and a loss of 27 pounds in weight. The pain became worse, requiring morphine for relief, and occurred at any time during the day or night without relation to food. The bowels were sluggish.

On admission the general appearance of the patient was that of a chronically ill, undernourished individual who was suffering from severe abdominal pain. His weight was 53.4 kg., his normal being rated at 65.7 kg.—a strictly bed patient with a temperature ranging from 98.6 to 101°F. and a pulse ranging from 80 to 110; he was extremely constipated. Physical examination revealed definite tenderness over right lower quadrant and a palpable mass thought to be a dilated cecum. Examination otherwise essentially negative.

Roentgenograms of chest showed mottling at both apices which was interpreted as tuberculosis.

Laboratory Data. Blood hemoglobin and red count normal; leucocytes totalled 20,200 with a differential count of 76 per cent polymorphonuclears, 14 per cent lymphocytes, 9 per cent mononuclears, 1 per cent eosinophiles; sedimentation test 33 per cent; complement fixation test negative for tuberculosis; Wassermann reaction negative. Urine showed

a trace of albumin and sugar. A guinea pig inoculated with urine sediment according to Petroff's method was negative for tuberculosis.

Serial roentgenograms of the stomach failed to reveal any pathology. A picture of the right lower quadrant taken eight hours following the ingestion of a barium meal revealed a deformity of the bowel in this area which was thought to be a deformed cecum and was classified as a tuberculous lesion (Fig. 1).

Examination of the small bowel by the method described above definitely located the lesion. A stricture of the ileum was found about one foot from the ileocecal valve with a dilatation of the small bowel both proximal and distal to the stricture. A second smaller stricture was seen a few inches proximal to the large one (Fig. 2).

With the foregoing findings the patient was referred for immediate operation. After further roentgenological studies at the hospital, a diagnosis of tuberculous enteritis was again made and surgical interference deemed inadvisable.

The patient was then returned to the Sanatorium and a careful dietetic regimen was instituted. A second examination by the method described above four months following the first revealed the same condition, and the patient was again sent to the same hospital with a recommendation for surgical interference.

The following is the report of the operative and pathological findings:

Report of Operation. Incision: To the right to midline.

The pelvis was completely filled with a stony hard mass, firmly fixed to the walls. The mass included small intestine. The small intestine proximal to the mass was dilated. It was obvious that no form of palliative treatment was feasible:

1. Enterostomy in the bowel above the mass would result in draining the small intestine too high.

2. No sidetracking operation could be undertaken as the lowest obstruction was in the pelvis.

3. The only reasonable procedure was to remove the mass. With great difficulty the mass was freed from the pelvic wall. It was then possible to lift the whole mass out of the abdominal cavity. A resection was performed from the cecum to the dilated bowel proximal to the mass. This involved about 16 inches of small intestine which was, to a large extent, almost completely obstructed as a result of involvement of the mesentery. It was assumed that the lesion was lymphosarcoma. While no masses were palpable elsewhere it was realized that radical cure was unlikely. The small intestine was closed at each end of the resection, and a side to side anastomosis performed between the cecum and ileum. The appendix

Fig. 1.

was thickened and chronically involved, possibly as a result of the same type of lesion as was present in the small bowel. It was removed. There was very little bleeding during the operation and practically no shock. The wound was carefully closed in layers without drainage. The patient received a clysis immediately after the operation and transfusion later in the day. Operation performed March 31, 1928.

Pathological Report, May 1, 1928. Mesentery lipoma. The specimen when received comprised a segment of small bowel 30 cm. long, arranged in fishhook shape around a slightly irregular ovoid mass incorporated in the mesentery. The mass measured 9 cm. in length and 6 cm. in diameter. The bowel and mass over the region of the curve of the fishhook were intimately united and well suited the operator's description of a mass which carried a loop of bowel downward in pendant fashion.

The bowel was of normal structure at either end with intact mucosa and of natural size. It was involved with the mass, its lumen was irregularly constricted and over the dependency of the curve was in several places constricted

to a diameter of 1 cm. In this portion areas were found where the mucosa appeared ulcerated and most of the mucosal surface polypoid and ring-like. The submucosa and muscularis plasia were seen and in addition a diffuse infiltration of lymphocytic cells through the stroma, as in muscular wall and, further, areas of lymphocytes with no orderly arrangement.

FIG. 2.

FIG. 3.

were increased to several times their normal thickness but were intact and regular.

The mass was firm and elastic and smooth of outline. The outer surface, but more clearly the surface formed by cutting, showed yellow areolar tissue through which glistening dry white strands of hyaline-like material interlaced. Towards the center of the mass the white material was accentuated into a semblance of a core and was dense.

No enlarged nodes or accessory masses were observed.

Histological preparations of the various portions were examined.

The section of the involved bowel showed large swollen mucosal folds, in places aggregated into large polypoid projections, as seen in the gross. Over the ulcerated areas and associated with them were acute inflammatory changes with fibrino-purulent deposits on the surfaces. Foci of round cells and granulations attested to older inflammatory changes. The glandular elements were frequently distended and mutilated. There was little necrosis.

Deeper areas showed a fading out of the more acute inflammatory reaction and a replacement with a lymphocytic one. Here areas of lymphoid tissues in a stage of hyper- In such areas the cells varied greatly in size and, especially in the frozen sections, suggested neoplastic qualities. Within the mass itself there was less reaction. The matrix was areolar tissue with denser connective tissue bands running through it and small colonies of lymphocytes in scattered portions.

No productive inflammation in the fat was observed and there was no evidence of tuberculosis.

Lymphoblastoma and tuberculosis being excluded as the primary lesion, a consideration of the cause suggested either primary intestinal inflammation developing on a polypoid mucosa with secondary inflammatory enlargement of the mesentery, or primary lipoma of the mesentery with constriction of the depressed loop of bowel, or possibly a small primary bowel tumor, as carcinoma, with obstruction and subsequent inflammation.

Though the bowel was carefully examined grossly for carcinoma and many areas examined microscopically, it must be admitted that carcinoma has not been positively eliminated, but this possibility is unlikely.

It was difficult to estimate the age of the intestinal inflammation though obviously of chronic nature, or still more likely, the result of

repeated acute attacks. The mass itself appears, in view of the areas of dense stroma, to be of considerable duration.

Distinction between the two most probable causes would appear to be most definitely made on the basis of the nature of the mass. It was difficult in examining sections from this tissue to believe it to be inflammatory in nature. Indeed large areas are frequent where no inflammation exists.

It is possibly true that compression of the normal loop of bowel has caused compression and thickening of the mesentery and so formed the tumor-like mass. This would be a matter of opinion and not subject to proof.

We believe that the process most probably began as a lipoma of the mesentery and that the mass was in some manner, either through being wrapped, or through its mass alone, responsible for a comparative degree of obstruction. In the affected area inflammation and polyposis developed secondarily.*

The patient made an uneventful recovery following the operation. The symptoms have entirely disappeared and there has been a return to a normal state of health, his weight reaching 59.7 kg. He is enjoying unlimited exercise and no dietetic restrictions. A third examination by our method, five months after operation, gave a normal small bowel, both as to its contour and function, also demonstrating the absence of the ileocecal valve (Fig. 3).

It is hoped that this method will prove of distinct value in many cases of small bowel pathology, and a detailed study of cases of tuberculous enteritis is now being undertaken to demonstrate the usefulness of this procedure.

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* We are greatly indebted to Dr. Eugene H. Pool and Dr. Gilbert Dalldorf for the use of their records of operation and pathological findings in this case.

DIVERTICULUM OF THE STOMACH

CASE REPORT

BY E. N. LILJEDAHL, M.D.

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THE following case of diverticulum of the stomach came under the observation of Dr. F. A. Speik and myself, Jan. 4, 1929. The clinical record is as follows:

FIG. 1. Barium shadow is seen in the cardia posteriorly.

FIG. 2. Barium seen in pocket in cardia at four hour examination.

Miss L., aged twenty-five, has been ill for the past year. She is very nervous and hypersensitive. She has frequent crying spells with palpitation of the heart and flushing of the skin. She has had some trouble in the right lung, but this is now healed. There are no symptoms referable to the stomach. The appetite is good—no pain or gas present at any time. The bowels move regularly.

Family History. There is no record of cancer or tuberculosis.

Past history gives no record of any disease of note. Menses are regular. There has been no jaundice or diarrhea.

Physical Examination. She is thin—weighing 90 lb. Head and neck apparently normal. Chest thin, presence of an old lesion right upper lobe. Heart shows nothing abnormal. Blood pressure, 105 systolic, 65 diastolic. Stomach is low. There are no masses or tenderness present.

Roentgen examination of the gastrointestinal tract was made Jan. 7, 1929. The esophagus was well visualized and presented no abnormalities. There was no spasm at the cardia. The stomach was long and low, the

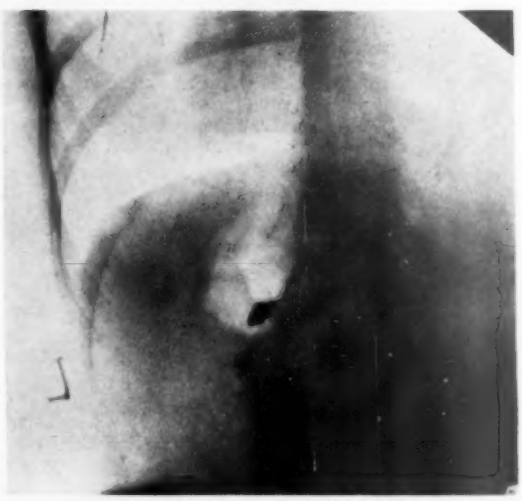

FIG. 3. Barium present in pocket with visible gas bubble superimposed on the normal gas shadow in cardia found at six hours.

lesser curvature slightly below the crest of the ilium. The outline was smooth and free from defects, except in the cardia slightly posteriorly where there was a definite pocket with a definite gas bubble superimposed on the normal shadow of the cardiac end of the stomach.

Barium was retained here at six hours when the remainder of the stomach was empty. The patient was thin so that this defect could be well observed. There was no connection with the esophagus. This pocket could be well seen projecting from the posterior wall in the cardia. It retained barium when the remainder of the stomach emptied, and a definite gas bubble could be seen over this barium residue superimposed on the normal stomach shadow. Pain could not be elicited at any time. The patient has had no symptoms referable to the stomach. The picture is that of a diverticulum of the stomach which has so far given no symptoms.

PRENATAL DIAGNOSIS OF ANENCEPHALY WITH SPINA BIFIDA

BY A. TREVENNING HARRIS, M.B., CH.B. (EDIN.)

HASTINGS, NEBRASKA

THOUGH anencephalus may be and is usually suspected clinically, the only positive means of diagnosis is afforded by roentgenography. The first report on this particular fetal monstrosity from the roentgenologic viewpoint was by Case[1] in 1916. Since this report some 15 cases in all have appeared in the literature. In his second article on this subject Case,[2] with Cooper, in reporting 4 additional cases, brings the literature on the prenatal diagnosis of anencephaly up to date.

Owing to the small number of cases of this condition successfully diagnosed before birth, I have thought it worth while to report a case which came under my observation in 1928 while I was radiologist to the Methodist Hospital,

FIG. 1. Lateral view of mother, fetus in utero.

FIG. 2. Anteroposterior view of fetus after birth.

Gary, Ind. In this instance both anencephaly and spina bifida were diagnosed and, owing to the absence of any scrotal shadow, the suggestion that it was a female fetus was ventured.

FIG. 3. Lateral view of fetus after birth.

CASE REPORT

Mrs. M. Y., aged thirty-four, multipara, a Jugo-Slav married to a Japanese. All four previous pregnancies were normal. Three children are living and well; one died in infancy, cause unknown.

Present Complaint. Abdominal enlargement was so great that respiration was interfered with. Severe abdominal cramps. Patient was in much distress.

Diagnosis made at patient's home was multiple pregnancy or polyhydramnios.

Owing to the depth of the abdomen anteroposteriorly a roentgenogram was not obtained in that position. A lateral view was taken (Fig. 1) and a diagnosis of anencephaly with cervical spina bifida in a female fetus was finally made.

The patient was admitted to the hospital at 11.00 A.M. and taken to the delivery room at 11.50 A.M. Under ether anesthesia the membranes were ruptured and two gallons of fluid were slowly released (two gallons were measured besides that absorbed by linen and lost on the floor). Uterine packing was instrumentally placed. At 9.14 P.M. a still-born, anencephalic monster was born. Postpartum course absolutely normal.

The points of interest in this case are the following:

1. An almost anteroposterior view of the fetus was obtained in the lateral view of the mother, thus facilitating the diagnosis of the cranium and cervical vertebrae.

2. Anencephaly was diagnosed by the absence of the bones of the vault of the skull; spina bifida by the absence of the spinous processes in the affected cervical vertebrae and the fact that the affected vertebrae appeared to be widened and flared out.

3. A fairly "soft" negative resulted in obtaining the whole outline of the fetal soft parts making the prenatal diagnosis of sex simple. Had it been a male fetus I have no doubt that the scrotum would have been visualized.*

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* I wish to express my thanks to Dr. Paul S. Yocum, Gary for permission to publish this case.

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Fifteenth Annual Meeting: To be announced.

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EDITORIAL

"CHRISTIAN'S" SYNDROME

TEN years ago, Henry A. Christian,[1] under the title "Defects in Membranous Bones, Exophthalmos, and Diabetes Insipidus, an Unusual Syndrome of Dyspituitarism; A Clinical Study" called attention to an unusual syndrome of early childhood.

His case, a girl aged five, was normal until the age of three; at which age her teeth began to decay and became loose and her gums became swollen. She had never been ill, except that she had mumps three or four months previously. When she was three and a half years old she developed an excessive thirst and polyuria. The right eye became prominent. These symptoms gradually increased in intensity until both eyes were protruding and she was drinking 9 quarts of water a day and urinating every hour. She complained of more or less pain in the head. The physical examination showed defects in the bones of the skull, marked degree of exophthalmos, loose teeth with swollen gums, some of the teeth missing and typical diabetes insipidus. Wassermann and tuberculin tests were negative. Blood examination showed a red cell count of 5,200,000 and a white cell count ranging between 6,600 and 20,100. The differential count on admission showed polymorphonuclears 30 per cent, lymphocytes 45 per cent, large mononuclears 23 per cent and eosinophiles 2 per cent.

Roentgen-ray study of the entire skeleton revealed extensive defects in the skull bones, slight but similar changes in the flat bones of the pelvis, and a quite normal appearance and normal stage of ossification and development of all other bones in the body. "The defects in the skull caused an appearance which can be best described by comparing them to the irregular holes in a bit of moth-eaten flannel or the appearance of a pasteboard box gnawed full of holes by mice."

The explanation of this unusual manifestation Christian concluded is difficult, but he considered the condition as probably due to a disturbance of pituitary function.

Since Christian's classical description of this rare syndrome of early childhood, additional cases have been reported from time to time, notably by Hand,[1] Grosh and Stifel,[2] Thompson, Keegan and Dunn,[3] Denzer,[4] and Kyrklund.[5]

All of the reported cases present almost identical clinical and anatomical pictures, the principal features of which are multiple cranial defects of varying sizes and shapes involving both tables of the skull as well as the base, particularly in the region of the sella turcica and the supra-orbital plates. Often the bones of the pelvis, spine and ribs are involved. There is an associated exophthalmos which may be extreme, often discharging ears, swollen gums and loose teeth.

Diabetes insipidus is a frequent occurrence and there may be enlargement of the spleen, liver and lymph glands and if the lungs are involved, as they often are in severe cases, there may be marked dyspnea.

The etiology of this unusual syndrome has been until recently unknown. Christian was of the opinion that the bony defects were caused in some way by disturbance of function of the pituitary gland, the cause of which was obscure. Thompson, Keegan and Dunn thought the etiological factor might have some relation to an antecedent infection, as most of the cases reported gave a history of one or more

[1] Contributions to Medical and Biological Research. Vol. 1. Paul B. Hoeber, Inc., 1919, pp. 390–401.

[1] Hand, Alfred. Defects of membranous bones, exophthalmos and polyuria in childhood; is it dyspituitarism? *Am. J. M. Sc.*, 1921, clxii, 509.

[2] Grosh, L. C., and Stifel, J. L. Defects in membranous bones, diabetes insipidus and exophthalmos with a report of a case. *Arch. Int. Med.*, 1923, xxxi, 76.

[3] Thompson, C. Q., Keegan, J. J., and Dunn, A. D. Defects of membranous bones, exophthalmos and diabetes insipidus. *Arch. Int. Med.*, 1925, xxxvi, 650.

[4] Denzer, B. S. Defects in the membranous bones, diabetes insipidus and exophthalmos. *Am. J. Dis. Child.*, 1926, xxxi, 480.

[5] Kyrklund, R. Beitrag zu einem seltenen Symptomenkomplex. *ztschr. f. Kinderh.*, 1926, xlvi, 56.

of the acute infectious diseases, but a necropsy of their case "while giving highly instructive and suggestive findings, fails to fix beyond all peradventure the nature and cause of the disease." Histopathological studies of their case pointed to an inflammatory rather than to a degenerative or primary metabolic process. They thought that the absence of a material pathological condition in the anterior lobe of the hypophysis excluded it as a factor in the bony defects. They believed that the preponderance of evidence was against an endocrinological origin for the syndrome. They concluded that "clinically and pathologically considered, destruction of membranous bones was the paramount disease process in our case, exophthalmos a mechanical effect, and diabetes insipidus probably a result of associated involvement of the tuber cinereum."

Here the uncertainty of the etiological factor in this unusual syndrome remained until Rowland[1] in a most comprehensive article described fourteen cases of this condition, twelve that had been previously reported in the literature and two new cases of his own, one of which he studied clinically and later at necropsy, bringing them as he says "into relationship with several similar cases that had been recorded as a special form of xanthoma" and the entire group he regards as "a generalized xanthomatosis, representing pathologic lipoid storage, or lipoid cell hyperplasia, of the reticulo-endothelial system."

The extraordinary cranial defects observed in one of Rowland's cases were caused by dural plaques, or tumor-like formations which consisted of masses of lipoid-containing cells of reticulo-endothelial type resembling xanthoma. Throughout were numerous multinuclear giant cells. These plaques did not suggest infectious granulomata, but, on the contrary, resembled xanthoma, or masses of cells of the xanthoma type. Fat stains showed the cells to be loaded with lipoid.

This same type of lipoid storage in the reticulo-endothelial cells was noted also in the lungs, which produced in Rowland's case the extensive fibrosis that is probably responsible for the dyspnea observed in some of these cases.

The initial process which brings about this unusual deposition of lipoid in the reticulo-endothelial system is not well understood, with our present limited knowledge of lipoid metabolism and its relation to general metabolism. Rowland believes that "Lipoid and various other substances in the body fluids become pathogenic for the organism, there being first an irritation of the vessel walls; then perivascular cell infiltration takes place, the lesions increasing as a result of the progressive blockage of the reticulo-endothelial system," and that "The hyperplastic reaction represents a compensatory act on the part of the body and is its attempt to rid itself of substances which cannot be properly excreted and that act as irritants." He suggests also the possibility that trauma or inflammation may account for the special localization of these cases, or that there may be some other factor as yet undetermined. The possibility of an infectious basis for the beginning of the process is to be considered because of the fact that in most of these cases a history of some previous acute infectious process can be elicited. Whatever the primary cause of this unusual manifestation, it is an interesting process and one in which there are many possibilities for further investigation.

The disease and its varied manifestations should be of particular interest to roentgenologists, because the bony changes incident to it are somewhat peculiar, and they should be considered to some extent in relation to various other bone diseases, such as Gaucher's disease and multiple myeloma, not only as a diagnostic problem, but from a therapeutic standpoint as well. While Rowland was able to control the process in one of his patients by restricting the lipoid containing foods and prescribing a diet consisting of moderate amounts of proteins and green vegetables, in addition to medication in the way of desiccated thyroid and anterior lobe pituitary by mouth, it is of interest to note that two independent observers

[1] Rowland, R. S. Christian's syndrome and lipoid cell hyperplasias of the reticulo-endothelial system. *Ann. Int. Med.*, 1929, ii, 1277–1299.

(Cignolini,[1] and Sosman[2]) were able to control similar lesions in their patients by therapeutic exposures of roentgen rays. "The irradiation has led to prompt and remarkable results. There was a rapid improvement in the bone changes, with complete disappearance of all the symptoms and there was healing of the diabetes insipidus" (Cignolini).

It would seem from the complete survey of the literature on the subject made by Rowland that lipoid metabolic diseases of the reticulo-endothelial system, which he terms "lipoid gout," are "by no means a rare condition."

L. R.

[1] Cignolini, Pietro. Loca land general effect of roentgen therapy in a case of diabetes insipidus associated with osteopathy. *Radiol. med.*, 1929, xvi, 16–21.
[2] Personal communication.

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SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan Ave., Toledo, Ohio.
Thirtieth annual meeting: Hotel Pennsylvania, New York City, Sept. 17–20, 1929.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual meeting, Detroit, Mich., 1930.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Fred M. Hodges, 801 West Grace St., Richmond, Va.
Annual meeting, Detroit, Mich., 1930.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. Walter T. Bronson, Northwestern Univ. Med. School, Chicago, Ill.
Fifteenth annual session: New Royal York Hotel, Toronto, Canada, Dec. 2–6, 1929.

RADIOLOGICAL SECTION, LOS ANGELES COUNTY MEDICAL SOCIETY
Secretary, Dr. Lowell S. Goin, Wilshire Medical Building, Los Angeles.
Meets on the third Wednesday of each month at the California Hospital.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. W. S. Lawrence, Medical Arts Bldg., Memphis, Tenn.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. W. T. Bronson, Englewood Hospital.
Meets monthly on second Thursday from October at to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Harry L. Farmer, 2930 Prospect Ave.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. E. R. Witwer, Harper Hospital.
Meets monthly on second Friday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee.
Meets first Friday in October, December, February and April.
Place of meeting designated by the president.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. E. Everett Rowell, 200 West 59th St.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary Dr. John T. Farrell, Jr., 235 S. 15th St., Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7.45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Metropolitan Building.
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

VIRGINIA ROENTGEN RAY CLUB
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Annual meeting, Charlottesville, Va., Oct. 18, 1929

British Empire

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Director, Dr. John Muir, 32 Welbeck St., London W. 1.

* Secretaries of societies not here listed are requested to send the necessary information to the editor.

Meets on the third Thursday of each month, from November to June inclusive, at 8.15 P.M., at 32 Welbeck St., London, W. 1., or as advertised.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8. 30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

SECTION OF RADIOLOGY AND MEDICAL ELECTRICITY, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.
Third session, Sydney, Sept. 2–7, 1929.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

SECTION ON RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.
Meets annually.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

SOCIETE DE RADIOLOGIE MÉDICALE DE FRANCE
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

SOCIETE FRANCAISE D'ELECTROTHÉRAPIE ET DE RADIOLOGIE MÉDICALE
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prague, 11/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GESELLSCHAFT FÜR RONTGENKUNDE UND STRAHLENFORSCHUNG)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Turin, Turin.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.
Sixth Annual Meeting, 1929, to be announced.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Elektorowicz, 19 Hoza St., Warsaw.
Meets annually.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Secretary, Dr. O. Wissing, Copenhagen
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

The American College of Surgeons will hold its nineteenth annual Clinical Congress in Chicago, October 14–18, 1929. Headquarters will be at the Stevens Hotel. An intensive program is being planned to

make this home-coming event the greatest in the history of the College. The Hospital Standardization Conference will consist of morning and afternoon sessions on Monday to Thursday inclusive. There will be a series of clinical demonstrations given by: George W. Crile, Cleveland; John B. Deaver, Philadelphia; John M. T. Finney, Baltimore; Charles H. Mayo, Rochester, and others. Monday evening's program will include an address of welcome by the Chairman of the Chicago Committee on Arrangements, Dr. Herman L. Kretschmer, the address of the retiring President, Dr. Franklin H. Martin, Chicago, the inaugural address of the new President, Major-General Merritte W. Ireland, Washington, D. C., and the John B. Murphy Oration in Surgery by Professor D. P. D. Wilkie of Edinburgh. Among the foreign visitors will be: Dr. James Heyman of Stockholm, Dr. Thierry de Martel of Paris, Visconte Aguilar of Madrid, and Mr. Herbert Tilley of London. Tuesday, Wednesday and Thursday evening sessions will consist of scientific papers presented by surgeons from the United States, Canada and from abroad. The Annual Convention of the College will be held on Friday evening. The Fellowship Address will be delivered by Dr. Glenn Frank, President of the University of Wisconsin. The annual meeting of the Governors and Fellows will be held Thursday afternoon followed by a symposium on cancer and bone sarcoma. An all day session on Traumatic Surgery will be held on Friday in which leaders in industry, labor, indemnity organizations and the medical profession will participate. A special program has been arranged that will be of interest to those whose practice is limited to surgery of the eye, ear, nose and throat. A feature of the Congress will be the showing of surgical films that have been produced under the supervision and approved by the Board on Medical Motion Pictures of the College. New developments in color photography will be demonstrated. In addition to the commercial exhibits, there will be scientific exhibits by the departments of the College. A rate of one and one-half the regular one way fare has been granted on railroads of the United States and Canada to those holding convention certificates.

VIENNA LETTER

(From Our Special Correspondent)

PROPHYLACTIC MEASURES FOR THE ELIMINATION OF DANGERS INCIDENT TO THE USE OF ROENTGEN RAYS

In a recent lecture Professor Guido Holzknecht expressed his views on the possibility of adequate protection in the use of roentgen rays. He said that the ever widening use and indications for roentgen therapy is attributable to the character of the effect of the roentgen rays, namely, a depression of the hyperactively growing tissue cells, and with this growing demand for the use of roentgen rays their ultimate practical value could not be realized so long as there is no established method of systematically averting the dangers connected with their therapeutic application. The protective measures to be efficient must be technical, administrative, clinico-roentgenological and psychological. The means for achieving this purpose may be classed in the following groups: (1) The automatic device. Every apparatus should be provided with a special automatic device which instantaneously switches off the primary current, if a mistake was made either before beginning the treatment or during the course of the treatment. This automatic device should be so constructed as to take care of any short circuiting which might occur during the course of treatment. An additional automatic device which is already installed on most of the apparatus now in use provides that only a certain maximal high tension current can be utilized. (2) The half-automatic device. (3) A further means for combatting the dangers from roentgen rays is to have a competent staff who have had considerable practice in handling the apparatus so that they automatically pay the strictest attention to averting dangers and to care of the patient. An important detail is the case histories of patients which should be so arranged as to clearly indicate all details of their treatment in an orderly

manner so that essential points of it may be revealed at a single glance at the history.

CLINICAL PROGNOSIS IN THE ROENTGEN TREATMENT OF CANCER

At a recent meeting of the Vienna Doktoren Kollegium, Dr. E. G. Mayer gave an address on the above subject. The conclusions reached were that the clinical behavior of a cancer and the attitude of its carrier do not allow any prognostic conclusion to be drawn as to the probable effect of the roentgen treatment. We only know that some tumors show more favorable results from the treatment than others. This fact induced Dr. Mayer to make a detailed study of the subject and he carried out his studies in the institute of Professor Holzknecht in Vienna. He made a follow up of all cases of cancer treated by roentgen rays without regard to the results obtained and he succeeded in finding some data which allowed the establishment of a probable prognosis in a given case. The most important points in the establishment of a prognosis are: Light cachexia. This condition is a favorable prognostic sign, contrary to what was hitherto believed. Likewise advanced age and good limitation of the tumor growth are favorable. Tumors which had a rather firm consistency gave a more favorable prognosis. Inflammatory reaction about the base of the tumor and tumors undergoing necrosis usually gave an unfavorable prognosis. A very important point in determining the prognosis is the stage of development of the tumor. Tumors which are seen shortly after their development are more favorable than those tumors seen late in the disease; the prognosis of those tumors which show early metastases is unfavorable.

ROENTGEN THERAPY OF ANGINA PECTORIS

Nemours and Barrien regard angina pectoris as a crisis of the cardio-aortic plexus. In such a crisis the important rôle is played by the sympathetic nervous system. They tried various physical methods but all these failed to bring any appreciable relief to their patients. Then they tried roentgen irradiation of the upper segments of the spinal cord. The technique they employed was 1 skin unit dose given over a period of three or four weeks to each of the cervical segments of the spinal cord in a dorsoventral position and to the upper dorsal segments in the ventrodorsal posture, the rays being directed through the left anterior chest wall. In 7 cases so treated the crisis and all of its concomitant symptoms ceased; even the arrhythmia improved. There are apparently no contraindications to the use of the roentgen rays in such a condition. Following their experience in angina pectoris, Nemours and Barrien extended their experiments to the treatment of other heart conditions and state that satisfactory results were achieved in cases of other disorders causing painful attacks in the region of the heart; notably in some instances of paroxysmal tachycardia.

THE INFLUENCE OF THE TENSION CURVE UPON THE ROENTGEN EFFECT

According to Dr. G. Varga (Hungarian Roentgen Society), of the electric energy conducted into the roentgen tube only the smallest portion becomes transformed into roentgen energy. The greater portion of the primary electrical energy is lost mainly in the form of heat. The relation of the roentgen energy to the electric energy conducted into the tube is the degree of efficiency which multiplied by the electric energy gives the roentgen effect. The degree of efficiency is dependent on the primary value of the tension and is approximately proportional with it. The degree of efficiency is illustrated by the following numerical data: with 50 kv. direct current tension it is about 1.2 per cent; with 100 kv. it is 2.7 per cent (it is understood that Wolfram cathodes are used). The degree of efficiency of a roentgen apparatus of any tension curve may be easily verified on the ground of degrees of efficiency pertaining to the primary values of the tension curve. According to Varga's calculations the most efficient results are possessed by the roentgen apparatus with two valve tubes and two condensors, the current of which, apart from some few per cent fluctuation, shows a straight line; next come those with revolving

rectifiers; then follow sets with one valve tube and two condensors (Villard system). Least efficient are the sets working without rectifiers, supplied with one valve tube, or four valve tubes, which latter are quite equal in efficiency but owing to their tension curve they are the least adapted among all tubes to therapeutic work. For deep therapy most suitable are the sets supplied with two valve tubes and two condensors. These apparatus excel by their dependability of function, their working without over-tension, which advantages cause them to be regarded as the most perfect for therapeutic use.

ULTRAVIOLET RADIATION FROM LARGE FORESTS

Some Austrian physicists made the observation a few years ago that forests have a great influence upon wireless reception. Receiving sets installed in the houses of rangers were exhibiting these static disturbances to a particularly noticeable degree, without anyone being able to find the cause. Now the French physicist, Albert Rodon, has apparently explained the cause of these disturbances. Different measurements which were made by himself and his assistants revealed the fact that the air in the vicinity of forests and particularly in the layers above the tops of the trees, is a strong electrical conductor. This conducting capacity of the air was attributed to the presence of ultraviolet rays in the air, a fact which has now been proved by the researches of the Russian professor, A. G. Gurwitsch. He discovered as early as 1923 that living plant tissue emanates ultraviolet rays in the process of cell division. His discovery has recently been confirmed by the experiments of the French physicist. The latter investigated chiefly the strata of air in the proximity of pine woods and he was able to show that these trees, during their summer vegetation, radiated a fairly large quantity of ultraviolet rays, sufficient to register on photographic plates. At the same time Rodon's experiments have cleared up another hitherto not quite understood fact; that of the physiological action of forest air upon diseased respiratory organs. It seems that this favorable effect of wood air (not only pine, but also other kinds of woods such as oak, willow, tan, etc.) owes its healing power to the ultraviolet rays.

ARTIFICIAL GOLD MADE WITH THE AID OF ULTRA ROENTGEN RAYS

One of the most prominent French physicists, Perrin, announced at a recent meeting of the Society for Nature Research in Paris that he is going to make a series of experiments for the transmutation of elemental stuffs, and particularly quicksilver, into gold, under the influence of ultra roentgen rays. The Austrian Hesz was apparently the discoverer of the ultra roentgen rays. A few years afterward Millikan in America carried on further work along this line. Kohlhörster, a German physicist, carried out experiments on the summit of the Jungfrau in Switzerland and brought to light the wonderful nature of these rays. The ultra roentgen rays can be demonstrated in the atmosphere on the pinnacles of high mountains; they are akin to the gamma rays of radioactive substances but are incomparably harder, with a penetrating power of about a hundred times that of radium rays. In the depth of the ice caves on the Jungfrau, Kohlhörster succeeded in demonstrating these rays behind ice blocks more than 10 meters thick; the rays are capable of piercing a block of lead 2 meters thick. Further investigations revealed that these rays originate from certain cosmic fogs which lock up stars in formation: worlds, which are likewise in an embryonal stage and consist of gases, the atomic structure of which differs essentially from the earthly gases. These yet unbound atomic energies may be the sources of the unearthly radiation which in a higher region of the atmosphere were discovered by Hesz, Millikan and Kohlhörster. The solution of this idea that this radiation is capable of provoking a transformation of our earthly elements lies near and renders Perrin's experiments likely to be successful.

The problem of transforming one element into another is a task which twenty years ago would have been regarded as technically impossible; at present, it is

the aim of atomic research. The task is bound up in the ability to break down the atoms. The diversity of the elements is, in the first row, stipulated through the number of the electrically loaded ultramicroscopic corpuscles, which, in every element, whirl around the atomic nucleus with an unheard of velocity. While in a quicksilver atom eighty such electrons are revolving, there are seventy-nine such revolving in a gold atom. The task of the transmutation of quicksilver into gold lies essentially in the freeing of the quicksilver atom from this one superfluous electron. In the past year encouraging results have been achieved by Rutherford in England and Kirsch and Petterson in Austria. They subjected the atoms of different elements to the action of the alpha rays of radium. These alpha rays bombard the innermost structure of the atoms. These experiments, however, had only a theoretical importance. Perrin is very sanguine and he asserts that what the alpha rays could not carry into reality the ultra roentgen rays will be able to perform. His laboratory experiments carried on in his own laboratory prior to his announcement to the society justify him, he says, in being most hopeful.

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DEPARTMENT OF TECHNIQUE

Department Editor: David R. Bowen, M.D., Pennsylvania Hospital, Philadelphia, Pa.

In this department will be published from time to time, as material is available, suggestions for improvement in technique.

A MODIFICATION OF THE CYSTOSCOPIC TABLE FOR ROENTGENOSCOPY OF THE KIDNEY*

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THE arrangement of a horizontal roentgenoscope so that a patient could be removed from the standard Young cystoscopic table for roentgenoscopic examination without in any way disturbing the patient or interfering with the flexibility of the table seemed to add considerable to the value of the usual technique of pyelography. It was found impossible to mount a roentgenoscope under the cystoscopic table because of the metal portions of the Bucky mechanism and the lack of suitable space for insulation, and for other obvious reasons. We have therefore devised an arrangement which combines a roentgenoscopic table with a Young cystoscopic table in such a way that the top of the cystoscopic roentgen table, to which are attached suitable leg-holders and upon which the patient remains without changing his position, may be rolled back on the roentgenoscopic table, allowing one to use the roentgenoscope or take films exactly as desired.

The bakelite top of the standard Young table was reinforced by a frame and a track (Fig. 1). Upon the front end of the frame were brazed two, heavy, 2 inch blocks of steel drilled to hold the stirrups supporting the legs of the patient. Five 2 inch rollers with 5/8 inch tread were mounted on each side of the inside of the frame of the table to accommodate the track of the bakelite top (Fig. 2). Precise adjustment was necessary to mount these so that they would not interfere with the Bucky diaphragm mechanism and yet support the carriage with the patient upon it. Upon the back of the carriage frame were mounted two rectangular "eyes" which slid over two projections upon the back of the table frame (Fig. 1). This effectually prevents the top from going forward too far or tipping forward if the table is tilted anteriorly. Two heavy

Fig. 1. Under surface of carriage showing (*a*) the simple brass channel track, (*b*) heavy dogs on the front, (*c*) the female portion of the rear locking device.

"dogs" and catches with thumb screws are placed on the front bar of the frame of the table to lock the carriage in place and prevent its becoming loose during manipulation of the cystoscopy table (Fig. 3). A tongue and groove locking device attached to the opposing ends of the roentgenoscopic table and the cystoscopy table lock the two firmly together with the rollers in alignment (Fig. 4). The top of the roentgenoscopic table is covered with 1 mm. aluminum through which protrude the 5/8 inch treads of the roller bearings upon which rides the traveling carriage of the cystoscopy table (Fig. 5). The top of the table is 7 feet in length to allow for considerable adjustment of the position of the patient.

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When the patient is to be moved from the cystoscopy table to the roentgenoscopic table, the two heavy dogs upon the front of the cystoscopy table are unlatched.

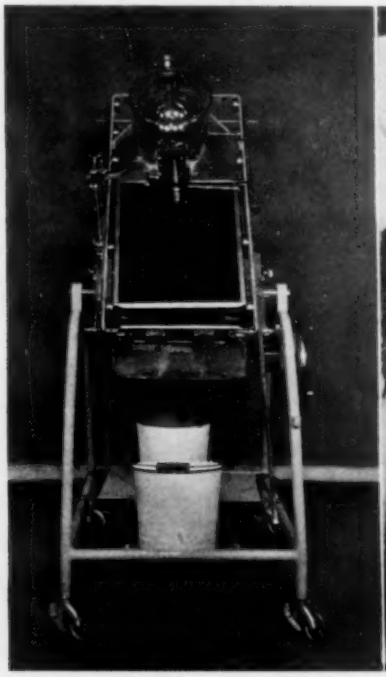

FIG. 2.

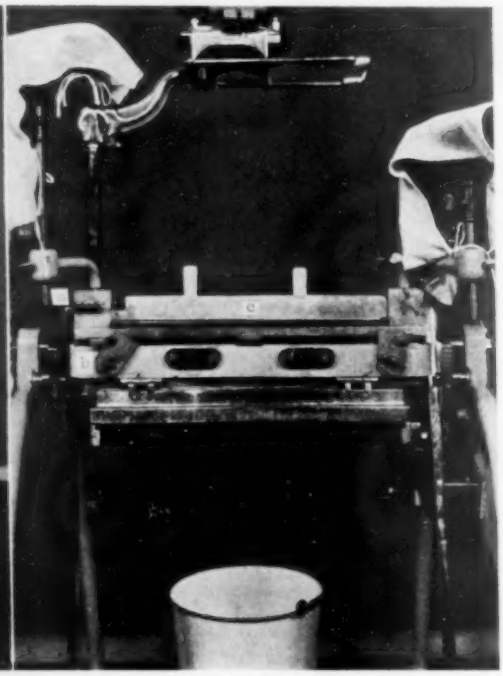

FIG. 3.

FIG. 2. Top of the Young table showing the arrangement of the roller bearings around the Bucky diaphragm.
FIG. 3. Front end of Young table showing (*a*) the blocks for the stirrups, (*b*) the heavy dogs locking the carriage, (*c*) the protective shield (upside down) preventing soilage of the Bucky diaphragm.

A drip shield is removed from the front (Fig. 3). The right stirrup is loosened and turned medially so that the leg of the patient and the stirrup will clear the roentgen tube carriage and bowl. The cystoscope, if it has not been removed, and the catheters are carefully picked up and the patient with the carriage is slowly and gently rolled upon the roentgenoscopic table. It is more satisfactory to use a cystoscope and tube holder which can be clamped to a leg rest or the end of the carriage. This holds the cystoscope and collecting tubes firmly, so that there is no discomfort to the patient, and no urine can drip upon the table. The roentgenoscopic table top has two stops which prevent the frame carrying the patient from sliding off of it, yet which allow free excursion of the carriage frame back and forth. Roentgenoscopic examination of the patient before the instillation of the opaque medium indicates the position of the catheters and often yields information which materially changes the usual procedure. Poor position of the catheters, coiling within the kidney pelvis, or undue pressure by the tip of the catheter upon the pelvis or a calyx can be remedied. The opaque fluid is run in under graduated

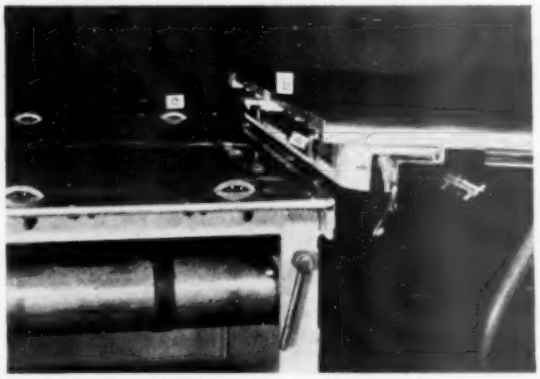

FIG. 4. The locking device to hold the roentgenoscope and cystoscopic table rigidly in line: (*a*) the claw member fitting into a niche upon the end of the roentgenoscope, (*b*) the carriage, (*c*) roller bearing extending through the roentgenoscope top.

pressure and the volume and time of the filling readily controlled. The kidney and ureteral regions can be palpated under direct observation and the mobility of these organs studied in detail. When this part of the examination has been satisfactorily concluded the patient can be rolled back upon the Bucky diaphragm in the cystoscopy table and films made in the usual or any specified manner. The emptying time of the kidney pelvis can be studied by subsequent roentgenoscopy of the kidneys every few minutes, after the catheters have been removed, until the kidney pelvis is empty. The procedure causes the patient no extra discomfort and in fact may lessen the pain frequently experienced when the pelvis is overdistended during the usual method of instillation of the opaque fluid.

The fixation of the carriage upon the cystoscopy table allows the patient to be elevated to any position or angle by the tilting arrangement. None of the flexibility of the table has been sacrificed or changed in any way.

Since completion of the apparatus it has been used for the examination of three cases, and one of these has been studied on two occasions. In each of the four examinations the table functioned perfectly. It was possible to see the pyelographic medium filling the pelvis and in this way to avoid excessive pressures. The gravity method was used and only sufficient elevation given to the burette to cause the pelvis to fill completely. Apparently owing to this fact, the discomfort caused the patients was less than when pyelograms were made blindly. Study of the films at a later time confirmed entirely in each case the conclusions reached through the roentgenoscopic examination.*

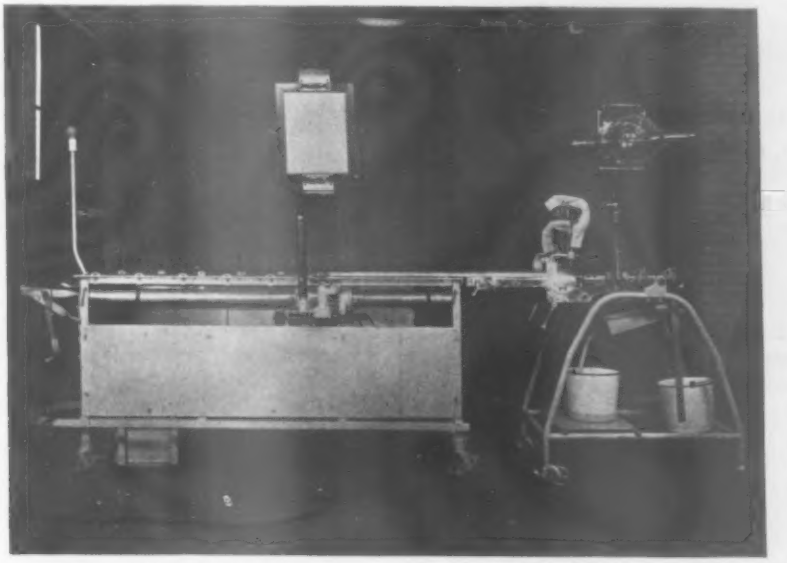

FIG. 5. The roentgenoscope locked to the cystoscopy table showing the frame carrying the patient across the junction. The right stirrup is shown in the proper position to pass the roentgen-ray tube freely.

* The modification of the cystoscopy table in our machine shop cost approximately, for labor and materials, $100.00. The cost of this change to the cystoscopy table and the adaptation of a roentgenoscope for this purpose seems very moderate in view of the additional information which can be gained.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

ALBANO, G. Roentgen diagnosis of triple pregnancy in the eighth month. *Zentralbl. f. Gynäk.*, Jan. 19, 1929, liii, 146–150.

The author describes a case of triple pregnancy in a woman thirty-two years of age. The roentgenogram, which shows a very fine detail of the fetal structures, is presented. This represents the seventh case published in the literature in which the diagnosis of triple pregnancy was made with the aid of roentgenologic examination previous to delivery.

In connection with this the author discusses the technique of exposure in the cases of multiple pregnancies. The anteroposterior film, because of the marked thickness of the patient, is as a rule without diagnostic value, but very good detail can be obtained in the lateral position. It is advisable therefore to follow Kreiss's instructions (given in 1914 for twin pregnancy) also for triple pregnancies and to make roentgenography in the lateral position in all instances with very large abdomens a part of the routine examination.—*T. Leucutia.*

ALBL, H. Aneurysm of the internal carotid simulating a pituitary tumor. A contribution to the diagnosis of intracranial aneurysms. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, xxxix, 890–894.

An aneurysm of the internal carotid is described in a man fifty-nine years of age. The roentgenogram showed a rounded area of increased density with very sharp outline and fine calcification of the margins. Since there was evidence of narrowing of the visual field with scotoma and since the described area was projected just above the pituitary region, a differential diagnosis from a pituitary tumor could not be made with certainty. The calcification observed in the roentgenogram was the result of calcareous deposits in the wall of the aneurysm.—*T. Leucutia.*

ALBRECHT, H. U. The present status of roentgen diagnosis in duodenal ulcer and its clinical significance. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, xxxix, 805–828.

After a brief review of the most important works contributing to the roentgenologic diagnosis of duodenal ulcer (Haudek, Cole, Gerber, Case, Chaoul and Stierlin, Åkerlund, and especially H. H. Berg), the author describes his own method of examination (which is that of Berg) and insists especially on the value of "regulated compression" and of roentgenoscopy in the two oblique positions ("fencing position" and "boxing position") during the examination.

Seventeen cases are described more or less in detail and illustrated with numerous roentgenograms. The following signs are considered more or less characteristic: (1) niche formation (en face, profile and relief niche); (2) retractions (deformities of the mucous membrane and shortening of the wall of the duodenum due to inflammatory processes or scars secondary to the niche); (3) delayed emptying of the stomach (resulting from narrowing of the lumen of the duodenum due to scar formation); (4) dilatation of the duodenum aboral from the ulcer; (5) involvement of neighboring organs, especially in cases of infected penetrating ulcers (liver, gall-bladder, pancreas).

A knowledge of anamnestic data is often of great help in establishing a correct diagnosis. The clinical methods of examination, however, have lost considerable ground since the development of the roentgen diagnosis. The author advises that the roentgen examination be repeated at different intervals so as to obtain a clear knowledge of the clinical course of the disease. In case of operation a preliminary roentgenologic examination is of great aid in exactly localizing the site of the lesion. A cooperation of the roentgenologist and surgeon is of utmost importance. A very detailed literature on the subject is appended.—*T. Leucutia.*

BONANNO, ANTONIO MATTEO. Pulmonary silicosis; clinico-roentgenological contribution. *Radiol. med.*, Feb., 1929, xvi, 121–153.

The study is based on a series of 18 cases of pulmonary silicosis observed in Italian workers employed in South African gold mines and later transferred to the Ospedale Mauriziano of Torino.

The silicosis in the South African gold miners is caused by the continuous inhalation of silica dust. The superficial strata of certain zones of the Transvaal are formed of quartzite containing free silica in a percentage as high as 90–96. The deeper strata which are really the ones important from the point of view of the miners, contain 1.86 per cent free silica in the form of quartz crystals. The dimension

of the silica dust particles entering the pulmonary tissues is on the average 0.5 to 5μ. These particles after being phagocytosed by the endothelial cells are transferred to the pulmonary lymphatics. Particles larger than 5μ remain in the alveoli of the lungs.

The changes observed within the lung tissues are the result of (1) the chemical action of the deposited particles (this being especially true of lead, arsenic and mercury particles); (2) fibrosis of the lung tissues provoked by the continuous mechanical irritation of the particles deposited, and (3) possible association with tuberculosis due to the injury of the alveolar epithelium by the long sojourn of particles within the alveoli.

Clinically one may distinguish between the forms of latent silicosis and fully developed pulmonary silicosis. This latter again may be either simple or associated with tuberculosis. The latent silicosis as a rule produces no clinical symptoms and is discovered only through routine periodical examinations of the miners. Likewise simple silicosis may be present without manifest clinical symptoms except for dyspnea and occasionally increase in weight. The appearance of cough with expectoration and diminution of weight represents a sign of alarm indicating the possibility of a tuberculous infection. The silicosis associated with tuberculosis may be the result of either primary silicosis complicated later by tuberculosis or silicosis in a case of primary tuberculosis.

The roentgenologic picture of simple silicosis consists in mottling and reticulation of the pulmonary tissues. The mottling may be fine, almost miliary, or coarse. In all cases of silicosis and pneumoconiosis there is marked enlargement and thickening of the hilar shadow. In the latent silicosis the same signs are observed with the exception that they are of considerably less extent. Reference is made to the classification of Pancoast and Pendergrass of pneumoconiosis into three stages and a description of these stages is given. From the point of view of differential diagnosis miliary tuberculosis, chronic miliary tuberculosis, calcareous concretions and pulmonary calculi, diffuse metastatic carcinomatosis and sarcomatosis, tertiary pulmonary syphilis and especially the various forms of pulmonary tuberculosis are considered.

In discussing the association of silicosis with tuberculosis the author expresses the opinion that silicosis because of its tendency to produce fibrosis may have a beneficial influence on tuberculosis of the lung. Moreover he thinks that the application of a treatment with silica compounds ought to be seriously considered in cases of pulmonary tuberculosis. There is no doubt that further experimentations along this line are justified.

Pneumoconiosis, on the other hand, may lead through continuous irritation of the alveolar epithelium to formation of pulmonary tumors. The increased frequency of pulmonary cancer in individuals inhaling various dusts has been repeatedly emphasized.

In comparing silicosis with pneumoconiosis a differentiation can be made in the majority of the cases purely on the roentgenologic appearance.

The 18 cases observed are described in detail and roentgenograms are presented. A bibliography of 46 references is appended.—*T. Leucutia.*

Breton, Marc. Calcification of the nucleus pulposus of an intervertebral disc. *J. de radiol. et d'électrol.*, May, 1929, xiii, 277–280.

A case of calcification of the nucleus pulposus of the disc between the ninth and tenth dorsal vertebrae, occurring in a man thirty years of age, is described. The condition was observed for a period of almost two years, and consecutive roentgenograms taken during that period showed a considerable increase in the amount of calcification. From this the conclusion is reached that the condition is not that of a simple anatomic malformation but that it represents a disease of a progressive character. A parallelism is drawn between the case observed by the author and that described by Calvé and Galland in 1922. The lesion is extremely rare.—*T. Leucutia.*

Cairns, Hugh. Observations on the localization of intracranial tumors; the disclosure of localizing signs following decompression or ventriculography. *Arch. Surg.*, April, 1929, xviii, 1936–1944; *Lancet*, March 23, 1929, i, 600–603.

It is well known that withdrawal of cerebrospinal fluid by lumbar puncture may aggravate the signs and symptoms of a tumor of the spinal cord. Cairns quotes a case of an elderly lady who was carried into the Peter Bent Brigham Hospital suffering from paralysis of both legs. For the previous seven months she had complained of increasing weakness of the right leg, but had been able to walk without assistance until one week before admission when, following a lumbar puncture, her legs became completely paralyzed. At operation, Dr. Cushing removed an intradural meningioma from alongside the midthoracic spinal cord and the patient made a complete recovery. The lumbar puncture was responsible, by the withdrawal of cerebrospinal fluid, for the

great increase in physical signs, thus converting an uncertain clinical picture into one of obvious tumor of the spinal cord. Observations of this nature have been made by numerous workers in the past, notably Elsberg, but that analogous changes may be observed in cases of intracranial tumor does not appear to have been so generally recognized.

The difficulties of localization of many brain tumors are great, and even with the aid of ventriculography and the method of ventricular estimation, exact localization is at times impossible. When no tumor can be found after exploration of the brain by an osteoplastic flap, the surgeon sometimes resorts to decompression to reduce the intracranial pressure. Experience has taught, however that certain patients become definitely worse after such procedure. This is not due as experience of trained neurosurgeons has shown to gross injury to the brain at time of operation. Cairns quotes a case of glioma (astrocytoma) of the left temporal lobe in which after exploration and decompression of the occipital region, a questionable difficulty in naming objects was converted into an obvious dysphasia. Paresis and disturbance of postural sensibility of the right side appeared as new signs. It is reasonable to assume that these changes in symptoms are attributable to a tumor of the left temporal lobe which, as a result of the occipital decompression, had become altered in size or in its relation to the left cerebral hemisphere. It is clear that the possible effect of a shift of the tumor should always be considered when decompression operations are performed.

He also quotes a case which affords a good illustration of the way in which a tumor of one frontal lobe may simulate a tumor of the opposite lobe. It was thought a tumor of the right frontal lobe was present but some doubt was felt about this in view of the fact that the sense of smell was impaired on the left side. Further examination also showed occasional weakness of the right side of the face. A ventriculography was done and thirty minutes after the air was injected, the right arm became extremely weak, and also distinct weakness of the right side of the face appeared, and the speech became slurred. The ventriculograms confirmed these recent clinical signs in showing a defect in the anterior horn of the left ventricle. At operation a tumor was found at the anterior pole of the left frontal lobe. Thus valuable neurologic evidence was obtained after the injection of air.

Ventriculography has certain dangers. Signs and symptoms may be aggravated and a certain number of fatalities will inevitably occur if air injection is used in cases in which there is a severe rise of intracranial pressure as shown by marked papilledema, stupor, intense headache and vomiting. Ventriculography is indicated in those cases where the rise in pressure is of but slight or moderate degree, and where no exact localization can be made by clinical means, and the danger of failing vision precludes any delay. The fact that in such cases as these the symptoms may be altered or aggravated by the injection of air is a clear indication that there should be as little delay as possible between ventriculography and the removal of the tumor. Withdrawal of the air after the roentgenograms have been taken will mitigate to some extent the danger of ventriculography, but too much stress cannot be laid on the fact that ventriculography should be followed with all possible speed by removal of the tumor at operation.—*R. S. Bromer.*

CASATI, ANNIBALE. Roentgenologic observations on alterations of bone in lupus pernio. *Radiol. med.*, May, 1929, xvi, 468–474.

Three cases of bone affections localized chiefly to the phalanges and to the metacarpals are described in lupus pernio. The condition is rare and was described for the first time only recently by Jüngling under the name of osteitis tuberculosa multiplex cystica.

Roentgenologically the lesion is characterized by small areas of rarefaction, rather well circumscribed, centrally located and of a cystic appearance. There is no atrophy or demineralization of the adjacent bones such as is usually observed in tuberculosis. The lesion also fails to show a tendency towards expansion, as, for example, in bone cysts. In one of the cases there was a pathological fracture.

The favorite sites of the affection are the bones of the hands. Differential diagnosis includes osteitis fibrosa cystica (Recklinghausen) and in rarer instances other neurotrophic affections such as syringomyelia, leprosy, sclerodermia and Raynaud's disease. The coincidence of the lesion with lupus pernio easily establishes the diagnosis.—*T. Leucutia.*

DITTMAR, OTTO. Lateral projection of the lumbar sacroiliac region. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, xxxix, 864–865.

The technique of the projection is as follows: The patient is placed postero-obliquely (half between lateral and supine positions) with a 30–35° angulation of the pelvis and body and a 30–40° flexion of the thighs. Films are taken with the aid of the Potter-Bucky diaphragm by using the regular exposure. A roentgenogram is presented illustrating the very fine

detail of the lumbar-sacroiliac region obtained by this projection.—*T. Leucutia.*

Dzialoszynski, A. What is the value of cholecystography in surgery? *Deutsche med. Wchnschr.*, April 26, 1929, lv, 695–696.

Based on his experience in 300 cases of cholecystography (which were done by the intravenous method with tetragnost), the author arrived at the following conclusions: (1) A good filling of the gall-bladder contraindicates surgical intervention. Fifteen cases in which there was clinical evidence of gall-bladder disease but in which cholecystography was negative were submitted to surgery for scientific interest, and it was found that in none of the cases was there present a condition which warranted a surgical intervention but that all cases could have been successfully treated by internal medication. Therefore the author is of the opinion that in the presence of clinical evidence of gall-bladder disease but negative cholecystography a medical treatment should be attempted first. (2) The evidence of negative gallstones in the cholecystogram forms an indication for immediate surgical intervention. (3) A non-filling of the gall-bladder may be the result of the following three conditions: (*a*) obstruction of the cystic duct; (*b*) inability of the gall-bladder to concentrate the dye (due to severe disease of the wall), and (*c*) severe functional changes of the liver (mechanical obstruction of the choleduchus, etc.). Surgical intervention is indicated in all these instances.

It is advised that other methods of examination also be taken into consideration before making a final diagnosis.—*T. Leucutia.*

Elkin, D. C. Primary neoplasms of the lymph nodes. *Arch. Surg.*, April, 1929, xviii, 1513–1530.

The author presents a clinical study of 41 cases of primary lesions of the lymph nodes. The neoplastic growths of lymphoid tissue which are considered are: (1) lymphatic and myelogenous leucemia; (2) Hodgkin's disease; (3) lymphosarcoma; (4) endothelioma. Case reports of these various conditions are given in detail.

Elkin concludes that irradiation seems by far the best method of treatment of these conditions which in the past have been subjected to operation. While not curative, it offers to the majority of patients definite palliation not only in the retardation of the growths but by an improvement of their general health. Especially is this true in lymphosarcoma and in certain forms of endothelioma. The duration of life is probably only slightly prolonged in Hodgkin's disease and in leucemia, but an improvement in subjective symptoms was usually noted. Only in acute leucemia does irradiation appear actually harmful.

Accurate diagnosis is an essential to treatment and prognosis, and with the exception of leucemia, this can be attained only by microscopic section. Careful removal of tissue for examination has not perceptibly appeared to spread the process or to affect the clinical course. Failure of the proper classification has led to much of the confusion which now exists concerning this group of malignant diseases, and it is possible that if a large number of cases are accurately classified and studied, sufficient data may be obtained to make a diagnosis without the necessity of biopsy.

From the clinical course alone, certain facts concerning the diagnosis of these tumors have been gained. For example, prodromal signs of weakness, loss of weight and anemia often appear in leucemia before the enlargement of the lymph nodes, and a study of the blood will usually establish the diagnosis. On the other hand, in Hodgkin's disease and in lymphosarcoma the first sign is the presence of tumors of the nodes. In the former the patient appears sick; there is usually an eosinophilia; the response to radiation is slow, and the recurrence is rapid. In lymphosarcoma the patient is robust and healthy; leucocytosis without eosinophilia is present; the response to irradiation is rapid, and recurrence is late.—*R. S. Bromer.*

Giraudi, Gioffredo. Ankylopoetic spondylarthritis (Fraenkel). *Radiol. med.*, Feb., 1929, xvi, 153–181.

Following the works of Goldwait, Fraenkel, Simmonds, Schlayer and v. Sieven, the author divides chronic ankylosing rigidity of the spine into (1) deforming spondylosis and (2) ankylopoetic spondylarthritis (Fraenkel).

1. Deforming spondylosis (or osteophytic vertebral rheumatism or vertebral arthritis deformans) is really a spinal localization of the common arthritis deformans. The underlying cause of the lesion is a degenerative process of the bony structures, while the inciting factor is a loss of elasticity of the fibrocartilage of the intervertebral discs resulting in secondary osteophytic formations chiefly at the points of greatest weight bearing of the vertebral bodies. The roentgenologic appearance of spondylosis deformans is typical: the intervertebral spaces are of different height (with occasional variation in the size of the vertebral bodies themselves) and there is evidence of osteophytic deposits characterized by a "beak"

appearance or in more advanced cases by a "bridge formation." In some instances there is concomitant involvement of one or several joints.

2. Ankylopoetic spondylarthritis (Fraenkel). This form first described by Fraenkel was variously called syndesmitis ossificans (Simmonds), spondylitis ossificans ligamentosa (Knaggs), etc. According to Fraenkel it represents a localization to the vertebral column of the chronic ankylopoetic arthritis described by Ziegler. The etiology and pathogenesis of the lesion are obscure. Gonococcic infection, secondary polyarthritis, acute articular rheumatism, traumatic influences (leading to a locus minoris resistentiae), etc., have been variously regarded as the provoking factor.

The clinical symptomatology is manifold. The most important clinical signs are the marked pain in the region involved and the rigidity of the spine due to the ankylotic process. In cases with additional involvement of the joints (sacroiliac, coxofemoral, humeral, sternoclavicular, temporomandibular, etc). symptoms on the part of these joints may complicate the condition.

Anatomico-pathologically ankylopoetic spondylarthritis may produce the following forms of intervertebral ankylosis: (*a*) entire conservation of the intervertebral spaces; (*b*) superficial ossification; (*c*) partial ossification localized especially to the anterior portion, and (*d*) total ossification.

The roentgenologic signs are as follows: (*a*) ossification of the ligaments; (*b*) ossification of the epiphyseal articulations; (*c*) formation of longitudinal columns along both sides of the spine due to sinostosis of the articular processes; (*d*) atrophy of the vertebrae; (*e*) frequent conservation of normal form, height and width of the vertebral bodies; (*f*) frequent conservation of normal intervertebral spacing; (*g*) frequent maintenance of normal opacity of the intervertebral discs as well as the vertebral bodies; (*h*) frequent bamboo-pole appearance of the dorsolumbar spine, and (*i*) frequent ossification of costovertebral articulations (Assmann) resulting in rigidity of the thorax.

The signs observed in the concomitant coxofemoral joint affections are: (*a*) ossification of the margins of the glenoidal cavity with occasional fibrosis of the capsule but with maintenance of the normal intraarticular spacing; (*b*) sinostosis (anatomical or functional) between the head of the femur and the articular surface of the acetabulum; (*c*) total ossification of the articulation. Occasionally similar changes are observed in other joints.

The points of interest differentiating ankylopoetic spondylarthritis from deforming spondylosis are as follows: (*a*) ankylopoetic spondylarthritis as a rule involves practically all segments of the spinal column, while deforming spondylosis is localized to only part of the spinal column; (*b*) the vertebral bodies in ankylotic arthritis maintain their normal appearance while in deforming spondylosis they show modifications of different degrees; (*c*) the longitudinal osseous column resulting from the sinostosis of the articular processes is observed only in ankylopoetic spondylarthritis; (*d*) the intervertebral spacing is of normal height in ankylopoetic spondylarthritis; (*e*) the vertebrae themselves show uniform osteoporosis in ankylopoetic spondylarthritis; (*f*) the ligaments of the vertebral column are unaltered in deforming spondylosis while they are systematically ossified in spondylarthritis; (*g*) if lesions extend to other joints of the body they appear in the form of arthritis deformans in deforming spondylosis and in the form of ankylotic manifestations in ankylopoetic spondylarthritis; (*h*) most important of all, however, is the appearance of the osseous bridges between the vertebral bodies. In ankylopoetic spondylarthritis they are arc shaped, fine and smooth, while in deforming spondylosis they are more or less irregular, coarse and of a "beak" type. Also while the bridge formation in ankylopoetic spondylarthritis occurs along both sides of the entire spine in the form of osseous columns, in deforming spondylosis it is localized only to part of the spinal column and appears less symmetrical.

The author discusses the relation of the rigidity of the spine produced by deforming spondylosis and ankylopoetic spondylarthritis to other spinal conditions such as chronic rigidity of the spinal column as described by Bechterew, and heredity traumatic kyphosis as described by Marie and Astié and arrives at the conclusion that the latter represent syndromes without any nosologic significance. In rhizomelic spondylosis as described by Marie and Léri, the terminology is analyzed in both the semeiologic and nosologic sense and the opinion is expressed that rhizomelic spondylosis semeiologically is either an ankylopoetic spondylarthritis or a deforming spondylosis with rhizomelic articular affections, while in the nosologic sense of Marie and Léri it represents a condition the anatomical basis of which is a menisco-ligamentitis ossificans and ankylopoetic spondylarthritis. Since the two definitions refer to one and the same nosographic entity it is advised that the term of ankylopoetic spondylarthritis be used.

Four cases are described in detail and illustrated with roentgenograms. A bibliog-

raphy of 57 references is appended.—*T. Leucutia.*

HAUDEK, MARTIN. The significance of the changes in the prepyloric region of the stomach. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, April, 1929, xxxix, 583–597; May, 829–858.

It is generally recognized that the diagnosis of lesions of the prepy oric region of the stomach is very difficult and that the errors committed here are the greatest. The reason of this lies in the fact that (1) the prepyloric region, also called canalis egestorius or antrum pyloricum, shows many anatomical variations which are on the borderline between the pathological and normal and (2) that all pathological lesions of the stomach known as the most difficult to diagnose are most apt to occur in this region. To take one single example, prepyloric ulcers show the largest percentage of malignant degeneration (8 per cent) and this makes a differential diagnosis from beginning carcinoma especially difficult. The matter is further complicated by the fact that 75 per cent of all gastric carcinomas occur in the prepyloric region.

In the first part of the article the author discusses the differential diagnosis of the carcinoma crater and the ulcer niche. Numerous examples are cited in order to prove that errors are possible even after the minutest examinations. In one instance, for example, the roentgenologic report was that of a beginning carcinoma, a fact which could not be verified either at operation nor at the histologic examination of the specimen and still the patient died later of carcinoma. In the differentiation of the malignant crater from the niche, special emphasis is laid on the appearance of the margins of the lesion as evidenced by the barium meal. In ulcer, the niche is sharply defined, has a regular outline and is occasionally spur-like. In medullary carcinoma, the crater shows an irregular outline, has a zone of decreased translucency at the margin (due to an infiltration around the carcinoma crater) and there is a protrusion cardia-ward of the lesser curvature at the proximal end of the lesion. In scirrhous carcinoma, there is in addition to the above signs a contraction of the greater curvature due to the scirrhotic induration of the gastric wall.

Of equally great importance is the appearance of the folding of the gastric mucosa around the lesion. In ulcer as a rule there is a convergence of the folds towards the niche, while in carcinoma, due to infiltration, there is a sudden disappearance of the otherwise normal folding. The peristalsis may remain uninfluenced in ulcer while in carcinoma a rigidity of the lesser curvature with entire lack of peristalsis may result.

In the second part of the paper the differential diagnosis of the prepyloric scirrhous carcinoma and the scirrhous-like canal formations is discussed. The different conditions which may lead to scirrhous-like canal formations are: (1) prepyloric ulcers; (*a*) those in which the diagnosis of ulcer is made with great probability, and (*b*) those in which the diagnosis is considerably obscured by the presence of spasm; (2) lesions with thickening of the wall of the stomach which at the time of operation may give an impression of carcinoma but which later may prove to be benign prepyloric lesions or lues. In the latter instance a differential diagnosis from scirrhous carcinoma is often impossible; (3) extensive narrowing of the canalis. The etiology of this benign canalis stenosis is not clear. In some instances it is the result of one or several prepyloric ulcers, or a localized gastritis, or other lesions of the mucous membrane. In other instances the muscularis and submucosa are also involved in the process as for example in linitis plastica, fibromatosis circumscripta, etc., and finally in others the anatomical changes are entirely missing and the stenosis is the result of a nervous irritation (total and circumscribed gastrospasms), as, for example, in the regional gastrospasm of Holzknecht and Luger or in the gastrospasms associated with organic nerve diseases, etc.; (4) the so-called "coning" of the prepyloric end of the stomach which extends over a section of only 1 or 2 cm. but which is sufficient (especially in cases suspicious of carcinoma) to warrant further investigations; (5) the curving of the prepyloric section of the stomach giving the appearance of a bird's head. This as a rule results from factors of extrinsic origin (tumors in the vicinity of the stomach, carcinoma of the pancreas, carcinoma of the gall-bladder, etc.). The salient points of differential diagnosis in the above cases are illustrated by means of numerous roentgenograms and case reports.—*T. Leucutia.*

HEISS, FR. Roentgenologic investigations of the joints in Olympian athletes. *Klin. Wchnschr.*, April 2, 1929, viii, 648–651.

During the last Olympian games in Amsterdam the author took roentgenograms of the different joints of 159 athletes in order to determine whether there are any changes resulting from an excessive use of parts of the body or of the entire body. The findings of Baetzner made previously on athletes in training were confirmed.

The changes observed were chiefly those of

periosteal thickening and calcium deposit at the insertion of the muscles and tendons. In a number of cases, however, changes were noted which lie on the borderline of the pathological. These are classified into three groups: (1) spur formations at the articular margins; (2) free bone formations near the joints, and (3) foreign bodies within the joints. Roentgenograms are presented showing these conditions.

In analyzing the frequency of the occurrence of the above changes in different branches of sports (long distance runners, middle distance runners, sprinters, jumpers, throwers, bicycle riders, boxers, wrestlers, discus throwers, and lifters) it was found that they occur mostly in connection with the excessive use of certain parts of the body. In the cases where the entire body takes part in the exercise as for example the decathlon athletes, the changes were entirely absent.

The disturbances observed in connection with the joints were not unlike those of beginning arthritis deformans. It is of interest that the middle distance runners presented the greatest percentages of disturbances.—*T. Leucutia.*

HOFMANN, K. Contribution to cholecystography with a new oral method (oral-tetragnost). *Münchcn. med. Wchnschr.*, April, 12, 1929, lxxvi, 629–631.

While American roentgenologists favor the oral administration of the dye in cholecystography, the intravenous method is preferred in Germany. The author believes that the reason for this lies in the fact that the German dye preparations are not so well tolerated by the patients as are the American preparations. In following the procedure of Kirklin (who administers the dye in grape juice) and that of Sandström (who uses a contrast emulsion of sodium tetraiodophenolphthalein with soda water) the author applied, through the courtesy of Merck, the oral administration of a new tetragnost preparation containing certain amounts of acids ("oral-tetragnost") and the results have been remarkable.

The fruit acid in Kirklin's procedure, the carbonic acid of the soda water in Sandström's method, and some similar acid in "oral-tetragnost" transform the sodium salt of the tetraiodophenolphthalein into an anhydrid (tetraiododioxyphthalophenon) which, as is known, is well tolerated by the stomach. In the intestine, due to the alkaline secretion of the bowel mucosa, the process is reversed and the sodium salt of the tetraiodophenolphthalein, which is easily absorbed, is produced.

Sixty-five cases were examined with the new "oral-tetragnost" and the results obtained have been superior to the ones obtained with any of the former capsule preparations both as regards the quality of the cholecystograms and the mildness of the reaction produced.—*T. Leucutia.*

JOELSON, JAMES J. Pyelitis, ureteritis and cystitis cystica. *Arch. Surg.*, April, 1929, xviii, 1570–1585.

Joelson reports a case of pyelitis, ureteritis and cystitis cystica, quoting Young's definition of this disease entity as a condition characterized by the presence of numerous small cysts of the mucous membranes of the urinary tract. The lesion may be limited to the bladder, but frequently it is found to be present also in the ureter and the kidney pelvis. Bullous edema of the bladder may sometimes resemble or be confused with cystitis cystica, but in the latter condition the cysts practically always have a definite epithelial lining.

The most generally accepted theory is that put forth by Von Brunn in 1893. He suggested that inflammation of the urinary tract at times caused downward proliferation of the epithelium which he termed epithelial buds or sprouts. Frequently the epithelial connection between the surface epithelium and the buds disappeared resulting in small groups of epithelial cells lying below the mucous membrane; these groups he called epithelial nests. Von Brunn thought that by the degeneration of the central cells of these small groups of cells, cysts were formed.

Joelson states that in his review of the literature no instance was revealed in which the diagnosis of the lesion of the renal pelvis or ureter was made by the pyelogram or ureterogram. His case presented very definite urographic evidence of ureteritis and pyelitis cystica. Roentgenograms of the urinary tract showed shadows of increased density which suggested multiple calculi of fairly large size in both kidneys. The location of these calculi seemed to be in the calyces of the kidneys rather than in the pelves. The pyelograms and ureterograms of both kidneys showed the shadows first noted in the regions of the kidneys to be calculi situated in the calyces. Both renal pelves were somewhat dilated. The ureters showed a marked degree of dilatation, and on the right side a kink was present. The pyelograms and ureterograms of both sides showed numerous small definite filling defects about 5 mm. in diameter, which were undoubtedly due to small cysts projecting into the lumina of the ureters and pelves. This was

especially marked in the left ureter. All pyelograms and ureterograms were repeated several times in order to eliminate the possibility that the small areas of decreased opacity were caused by air bubbles. Joelson concludes that this appearance is definite and characteristic of this condition.—*R. S. Bromer.*

Joseph, Eugen. Acute iodine intoxication following pyelography with umbrenal. *Deutsche med. Wchnschr.*, Feb. 22, 1929, lv, 313.

The author has performed over 2000 pyelographies with the use of umbrenal and only one accident was observed which occurred at the beginning. The case was that of a woman with very marked hydronephrosis on one side and with a limited function (ureteral stone with partial occlusion) of the kidney on the other side. Eighty c.c. umbrenal was injected into the hydronephrotic kidney. The introduction of such a great amount of iodine later led to acute iodism which took several days to disappear. With the improvement of the technique and reduction of the amount of umbrenal injected (12 c.c. is only rarely exceeded), no further accidents were observed.

The author mentions this as a refutation of a statement by Fraenkel who on the basis of a recent case of acute iodism following the injection of only 2.5 c.c. umbrenal maintains that the use of umbrenal carries considerable danger. Nevertheless, it is advisable to make a thorough inquiry as to the iodine tolerance of the patient and especially as to whether iodine medication was applied shortly previous to the examination. In such instances it is better to use sodium bromide as a contrast medium.—*T. Leucutia.*

Kiffner, Fritz. Stereoroentgenograms in twin placentas. *Arch. f. Gynäk.*, March 20, 1929, cxxxvi, 111–121.

The author injected the placentas of 25 twins by a contrast medium according to the technique of Vogt and after hardening the placentas in 2 per cent formol solution examined the distribution of the blood vessel system by stereoroentgenograms. The conclusion was reached: (1) that a simple roentgenogram is not sufficient to demonstrate the blood vessel system of multiple placentas but that stereoscopic roentgenograms are necessary. In doubtful cases the placentas should be examined from both the fetal and uterine side; (2) that monochorionic twin placentas show connection of blood vessels, but that in the dichorionic twin placentas no connection of the blood vessels can be demonstrated.—*T. Leucutia.*

Koester, Friedrich. Situs inversus with relaxation of the diaphragm. *Deutsche med. Wchnschr.*, May 3, 1929, lv, 746–747.

A case of situs inversus with relaxation of the right dome of the diaphragm is described in a man forty-four years of age. The complaints were in connection with the relaxation of the diaphragm. The situs inversus itself produced no symptomatology. The case is described because of its rarity.—*T. Leucutia.*

Litten, Fritz. The roentgen diagnosis of the azygos lobe, especially its visualization through stereoscopic films. *Deutsche med. Wchnschr.*, March 8, 1929, lv, 400–401.

Six cases of azygos lobe were observed during the past one and a half years in a series of 8000 chest examinations.

The two chief anomalies visualized in the roentgenograms in connection with azygos lobe are (1) the presence of the vena azygos, and (2) the reduplication of the pleura around the vena azygos.

Differential diagnosis includes: substernal thyroid, pleural bands (adhesions) and in case of disease of the azygos lobe pleural thickening, infiltration of the lung and atelectasis. Especially in these latter instances stereoscopic roentgenograms might be of considerable aid.—*T. Leucutia.*

Lorey, Alexander. The technique of bronchography. *Deutsche med. Wchnschr.*, March 29, 1929, lv, 526–527.

In order to obtain a good injection of the bronchial tree of all lobes the author advises the use of a special rubber catheter which is introduced by means of a bronchoscope into the lung or lobe to be injected.

The detailed technique is as follows: One hour previous to the examination morphium-scopolamin is given subcutaneously. Following a local anesthesia of the pharynx and glottis (with 5 to 10 per cent cocaine), the bronchoscope is introduced and then the region of the bifurcation is anesthetized with 5 per cent cocaine or alypin, by being very careful, however, not to apply a too large amount of the solution. After the completion of the anesthesia, which as a rule takes but a few minutes, the catheter is inserted with the aid of a bronchoscopic forceps and then the bronchoscope is removed. At this moment, the patient is controlled roentgenoscopically as to whether the tip of the catheter (which is slightly dilated in the form of an olive) lies in the right position. If so, the contrast medium is injected, likewise under roentgenoscopic control. For the injection of the lower lobe the patient is placed in a

sitting position, while for the injection of the middle lobe he is laid on the side and for the injection of the upper lobe he is placed on the side with elevated pelvis. The use of Pohl's omniscope is especially advantageous in this respect.

Special attention is called to the fact that the application of larger quantities of cocaine on the mucous membrane of the bronchus or of the upper respiratory tract (when applying the anesthetic in the form of a spray) may result in a cocaine poisoning with fatal termination. Such an accident occurred in one case following the administration of 2 c.c. of 5 per cent alypin in the trachea.

Also while the author previously opposed the use of the bronchoscope as too complicated and advised the introduction of the catheter under laryngoscopic control (following anesthesia of the upper respiratory tract by spraying), he is now convinced that the bronchoscopic method, since it permits the application of the anesthetic by means of swabbing, is considerably safer.—*T. Leucutia.*

LOVISATTI, NICOLA. The roentgen appearance of the azygos lobe. *Radiol. med.*, April, 1929, xvi, 377–381.

The roentgenograms of three cases of azygos lobe are presented and in connection with these the roentgen characteristics of azygos lobe are discussed.—*T. Leucutia.*

LUCCIONI, CONSUELO. Congenital diverticulum of the sigmoid. *Radiol. med.*, May, 1929, xvi, 492–494.

The author describes an unusual diverticulum of the sigmoid, in a patient forty-three years of age, which was accidentally discovered during the course of an operation and which was later demonstrated roentgenologically. The diverticulum was cylindrically shaped, of considerable length and possessed the ability to empty itself spontaneously. The case which no doubt is a congenital malformation is presented because of its extreme rarity.—*T. Leucutia.*

LUNDBERG, SVEN, and LILJA, BENGT. Three cases of intraperitoneal multiple abscess formation after appendicitis where radiographic examination enabled abscesses to be diagnosed impossible of being localized by clinical methods. *Acta chir. scan.*, April 23, 1929, lxiv, 557–567.

Three cases are described in which localized peritonitis (following appendicitis) was diagnosed roentgenologically, while the clinical examination failed to reveal the true nature of the process. The roentgenograms in the cases are presented and the following signs are emphasized: (1) Intestinal paresis resulting in gas distended coils of the small intestine with horizontal fluid levels; (2) appearance of shadows of increased opacity between the gas distended coils of the small intestine, with multiple, wedge-like disturbances of the contour of the shadow, indicating the encapsulation of the abscesses by the adjacent bowel coils; (3) spastic conditions of the colon in the region near the exudate (as demonstrated by barium enema); (4) increased opacity with blurring around the abscess due to infiltrations of the subperitoneal tissues.

The conclusion is reached that diagnosis is often obtained by simple flat roentgenograms but that in many instances the addition of barium enema is of considerable aid.—*T. Leucutia.*

NEMENOW, M. An apparatus for lumbar puncture and injection of contrast media for roentgen diagnosis. *Deutsche med. Wchnschr.*, May 31, 1929, lv, 914–915.

The author describes an apparatus which can be used simultaneously for lumbar puncture and injection of lipiodol into the cerebrospinal space. The apparatus can also be employed for pneumoperitoneum, encephalography, etc.

The principle of the apparatus is that the needle which is a simple lumbar puncture needle (with an arrangement to measure the depth of insertion) is provided at the outer end with a three-way cannula, one way leading to the manometer, the other to a syringe (for the injection of the contrast medium), and a third ending freely for the drainage of the cerebrospinal fluid (or other fluids). By simply turning a stopcock, any of the cannulas can be connected to the needle. The apparatus is also supplied with a two-bottle system for the injection of the contrast media under a steady, well-controlled pressure (pneumoperitoneum, etc.).—*T. Leucutia.*

NORDENTOFT, JACOB. Roentgenologic study and the conservative non-surgical roentgenoscopic reduction of acute intussusception in children. *Acta chir. scan.*, April 23, 1929, lxiv, 519–526.

Five cases of intussusception in children are described in detail. In 3 of the 5 cases the intussusception was reduced under roentgenoscopic control. The fourth case died and the fifth (colicolic intussusception) recovered following operation.

In connection with these cases attention is drawn to the roentgenologic signs of intussusception (the most important of which is the brusk arrest of the barium column at the

place of the intussusception terminating with a convex margin and occasionally showing an outer area of decreased translucency), and emphasis is placed on the necessity of attempting a reduction of the intussusception under roentgenoscopic control. If the reduction fails surgical intervention is indicated.—*T. Leucutia.*

Ottonello, Pietro. The anomalies of the thoracic cage in relation to the clinical examination of the lungs. *Radiol. med.*, April, 1929, xvi, 382–390.

The author discusses the different anomalies of the upper thoracic cage which may influence the results of percussion of the apices in the clinical examination of the lungs: (1) cervical ribs; (2) partial fusion of the first and second ribs; (3) coracoclavicular articulation; (4) bifurcation of the ribs, and (5) calcification of the first costal cartilage. Since all these anomalies are invariably unilateral they may lead to errors of percussion on the affected side. Therefore, the author advises that roentgenography of the thorax be made part of a routine examination in all cases with abnormal percussion findings of the lungs.—*T. Leucutia.*

Pescatori, Guido. Contribution to the roentgenologic diagnosis of tumors of the left hypochondrium in connection with a case of echinococcus cyst. *Radiol. med.*, May, 1929, xvi, 527–541.

A case of echinococcus cyst occurring in the left upper quadrant in a man twenty-three years of age is described and several roentgenograms are presented. Due to calcification of the wall of the cyst the diagnosis was made without difficulty.

In connection with this case the author discusses the differential diagnosis of the various tumors of the left upper quadrant (enlarged spleen, subphrenic abscess, pancreatic cyst, retroperitoneal tumors, etc.) and arrives at the conclusion that the gastrointestinal examination by means of a barium meal, the pyelogram and occasionally pneumoperitoneum are of considerable aid in establishing a correct diagnosis.—*T. Leucutia.*

Prosoroff, A. The procedure and method of localizing encapsulated costal pleuritis, foreign bodies and morbid processes in the thorax. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, xxxix, 895–898.

The author describes a simple procedure for the localization of encapsulated effusions, foreign bodies and other circumscribed lesions of the chest. It consists in the application of a band provided with a metallic coin as marker which is tied around the patient's chest at the level of the shadow to be investigated. By turning the patient in different positions (under roentgenoscopic control) and by measuring the distance of the questionable shadow from the metallic coin in the different views a localization of the process is made. The method is of considerable aid in the extraction of foreign bodies as well as in cases of thoracocentesis and other surgical interventions with insufficient localization of the pathological lesion.—*T. Leucutia.*

Roseno, A., and Jepkens, H. Intravenous pyelography. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, xxxix, 859–863.

Intravenous pyelography was first tried by Rowntree, Osborne, Sutherland and Scholl in 1923. Later the method was repeated by Rosenstein and v. Lichtenberg and by Volkmann but was soon given up as of not sufficient practical value. In reopening the subject, the authors found, on the basis of numerous experiments on dogs, that if the intravenous injection of sodium iodide is combined with urea a contrast is produced which is satisfactory enough to visualize the kidney pelvis. In the first experiments the ureters were ligated so as to produce a slower excretion of the urine but later this was replaced by preliminary (subcutaneous) injection of morphine which as is known exercises an inhibiting effect upon the bladder musculature. The sodium iodide and urea (the exact concentration and the amount of which will be published later) were injected directly into the femoral vein under ether narcosis.

The addition of the urea, because of the diuretic effect of this drug, accelerates the excretion of the contrast medium through the kidney, thus leading to a greater concentration and better visualization of the kidney pelvis.

The results have been so satisfactory both from the technical and clinical standpoint that the method was extended to humans. In a future article the results of the investigations in humans will be published.—*T. Leucutia.*

Sergent, Émile. Tuberculous perilobulitis: Roentgenological study. The rôle of the lymphatic vessels in the process of the interstitial pulmonary tuberculosis in adults. *Presse méd.*, May 22, 1929, xxxvii, 665–666.

After a brief discussion of the different conceptions of pulmonary tuberculosis, the author presents a series of roentgenograms in support of his own view according to which pulmonary tuberculosis is not always an "open" lesion characterized essentially by broncho-alveolitis, but in many instances it

represents a "closed" process of the interstitial type leading to the formation of perilobulitis. The idea of the interstitial propagation of tuberculosis is not a new one and was more recently endorsed on the basis of anatomopathological investigations by such eminent men as Bezançon and Braun but no roentgenological evidence has been brought so far. This is the more interesting since the existence of tuberculosis of the hilus as well as of the great trunks is now generally admitted and the roentgen appearance is well known. One may naturally assume therefore that the tuberculotic process may extend further along the smaller trunks towards the terminal ramifications of the interstitium, thus leading to a picture similar to that frequently observed in pulmonary syphilis and which the author prefers to designate as perilobulitis. The importance of the lymphatic vessels in the propagation of this condition (by contiguity or at a distance) is evident.—*T. Leucutia.*

SERGENT, ÉMILE. Roentgenologic iconography of tuberculous perilobulitis. *Presse méd.*, May 29, 1929, xxxvii, 697–699.

The author presents a series of roentgenograms illustrating a picture which he considers typical for tuberculous perilobulitis, and which he characterizes as follows: There is accentuation of the interstitial reticulum, in places (especially when projected in the transverse diameter) giving a honeycomb appearance which is very similar to that of the multiple cavitation of the lung parenchyma except that the nests are polygonal and of a rather uniform size (while in the multiple cavitation they appear more rounded and of varying sizes. A second very important feature from the point of differential diagnosis is the evolution of the tuberculous perilobulitis which may be (*a*) progressive, leading to production of more or less extensive foci of consolidation, (*b*) regressive, leading to a roentgenological clearance of the process, (especially in case of inflammatory scissuritis and periscissuritis), and finally (*c*) terminating in calcification. In this latter instance one may find a veritable constellation of small calcareous concretions diffusely scattered over both lung fields.

The rôle of the lymphatic paths in the propagation of the interstitial tuberculosis is clearly demonstrated in the investigations of Bezançon and Braun. However, while these authors describe a more or less generalized form of interstitial tuberculosis, perilobulitis represents a localized form indicating merely the path of propagation of the infection and the inflammatory reaction produced therefrom (this latter often constituting a veritable reticulitis). In this respect, perilobulitis represents a direct communication by contiguity or continuity with the primary focus of the disease which may be intraparenchymatous or hilar. Several examples of reactivation of latent intraparenchymatous tuberculous foci as well as of latent foci of the hilus are presented and illustrated by roentgenograms, proving that perilobulitis is a phenomenon to be reckoned with in such instances.—*T. Leucutia.*

SPILLMAN, RAMSEY. Dermoid cysts of the ovary. Roentgen observations. *Arch. Surg.*, April, 1929, xviii, 1298–1303.

Spillman reports a case of dermoid cyst of the ovary in which before operation certain shadows were noted on the roentgenogram, overlying the left side of the sacrum, but their nature was not determined until after the operation. On the film of the cyst after operative removal, a well-developed tooth of the form of an upper cuspid was found, with another tooth lying obliquely over it. The root canal of the cuspid tooth was clearly shown. A curving bone was thought to be due to an attempt at the formation of a maxillozygomatic region, and a clear suture line was visible between the two parts of the bone. When this postoperative film was compared with the preoperative film, these structures could be visualized on the latter. The author believes that the roentgen method of examination should be of use as a means for the orientation of sections from such a tumor.

The literature is reviewed and in conclusion, Spillman emphasizes the fact that roentgenologists should be on their guard not to be misled by the shadow of such a tooth overlying the course of the ureter, and mistake it for a calculus. Ureteral catherization is in order in the examination of female patients who have symptoms and manifestations of stone in the lower part of the ureter. When shadows are found on the roentgenogram of a pelvis of a woman and their nature is not evident, ossification in a dermoid cyst must be kept in mind. If routine roentgen examination were the rule in cases of enlargement of the adnexa, no doubt many more dermoid cysts would be identified before operation.—*R. S. Bromer.*

STEPHANI, JACQUES. A rare pulmonary malformation: subclavicular hilus. *J. de radiol. et d'électrol.*, May, 1929, xiii, 281–285.

Although congenital malformations of the lungs and other structures within the chest are not infrequently observed, malformations of the hilus belong to the rarest occurrences. During the examination of a man fifty-three

years of age who suffered from "chronic bronchitis" (for a period of twenty-five years' duration) the author found a bilateral fibrocaseous tuberculosis with a very peculiar congenital malformation of the hilus. It appeared as though the hilus and the roots of the lung were drawn up originating immediately underneath the clavicles and radiating downward and laterally towards the lung fields. The condition was designated as subclavicular hilus.—*T. Leucutia.*

Stumpf, Pleikart. Densography as a method of more accurate reading of roentgenologic images. *Münchcn. med. Wchnschr.*, April 5, 1929, lxxvi, 588–592.

Densography is a method permitting the graphic tracing of different densities of a roentgen image. The so-called electric eye is used for this purpose, which consists of a light electric cell similar to the one used in telephotovision. The variation in current of the light electric cell due to the change in the intensity of the light transmitted by the various densities of the roentgenologic image is registered by means of a mirror galvanometer on a photographic film and thus a tracing is made. If the tracings are taken at regular distances of 1–2 cm. (as, for example, in the heart) and if the points of equal density are connected, the curves so obtained are called isograms.

Isography has a certain diagnostic importance in the detection of obscure brain tumors, in functional determinations of the heart and especially in functional measurements of the lungs. In this latter, isograms are made both in inspiration and expiration (by taking the two exposures on the same film) and from the changes in the isographic curves certain deductions are drawn with regard to the function of the different lobes or parts of the lungs.

The method, of course, is far from being perfect and further investigations are necessary in order to make densography and especially isography of real practical value.—*T. Leucutia.*

Talia, Ferdinando. Adherent perigastritis (a clinical, roentgenological and operative study). *Radiol. med.*, March, 1929, xvi, 300–326.

The most frequent lesions leading to adhesions of the stomach are: (1) gastroduodenal ulcers; (2) circumscribed or diffuse peritonitis; (3) infections (colon bacillus, phlegmonous perigastritis. etc.); (4) tumors, and (5) in rare instances syphilis, tuberculosis, plastic linitis, etc.

The site of the adhesions may be on the pyloric end, cardiac end, lesser curvature, greater curvature, anterior wall, posterior wall and generalized.

The roentgenologic diagnosis is based on an abnormal position, deformity, fixity, stability and tenderness on pressure of the stomach or part of the stomach involved.

The cases are described in detail all of which had developed adhesions as a result of repeated inflammatory exacerbations of old chronic ulcers.

The following conclusions are reached: (1) in circumscribed perigastritis; (*a*) the roentgenologic as well as the clinical diagnosis is difficult; (*b*) the position of the stomach is deviated towards the site of the adhesion; (*c*) the stomach is deformed; (*d*) the gastric contours show certain irregularities; (*e*) the motility is restricted and the manual displacement causes considerable pain; (*f*) the new position of the stomach is stable in all postures of the patient, and (*g*) the function is irregular.

(2) In generalized perigastritis; (*a*) the roentgenologic diagnosis as a rule is easy while the clinical diagnosis is difficult; (*b*) the stomach occupies a high position (retracted); (*c*) the form is irregular and varies (gastric deformation); (*d*) the gastric contours are irregular; (*e*) the manual displacement of the stomach is limited and causes considerable pain; (*f*) the capacity of the stomach is reduced (microgastria); (*g*) the stomach is fixed and stable in its new position in every posture of the patient; (*h*) the function is irregular (stenosis, pyloric incontinence, etc.).—*T. Leucutia.*

Talia, Ferdinando. Roentgen diagnosis of abdominal extrauterine pregnancy. *Radiol. med.*, May, 1929, xvi, 453–468.

Two cases are described in which abdominal extrauterine pregnancy was diagnosed with certainty by means of roentgen examination. In the first case, that of a woman twenty-four years of age, the pregnancy was five months old and the roentgenogram revealed the presence of fetal structures at the level of the second lumbar vertebra. In the second case, that of a woman forty years old, which is of still greater interest since the pregnancy was of only four months' duration, the roentgenogram revealed a very faint outline of fetal structures likewise at the level of the second lumbar vertebra. In both instances the abdominal pregnancy was complicated by infection. Following surgical intervention there was, however, complete recovery.

In connection with these 2 cases the author briefly discusses the incidence of extrauterine

abdominal pregnancy as well as the value of roentgenologic examinations in the different periods of pregnancy. It is generally admitted that fetal structures are visualized with certainty only from the twenty-second week on. The second case of the author, therefore, is of particular interest since the fetal structures were evidenced much sooner.—*T. Leucutia.*

TEEL, CHARLES. Diverticulum of the bladder. *Arch. Surg.*, April, 1929, xviii, 1896–1903.

The author reviews 31 cases of diverticulum of the bladder. He is especially impressed by the frequent association of neoplasm and calculus with diverticulum. In the group studied, there was a sac o not less than 2 cm. in diameter in every case. In 10 cases, or 30 per cent, there were multiple diverticula; in 5 others, the records mention the presence of additional cellules or saccules, varying in size up to 0.75 cm. in depth.

The diverticula were found predominantly in men, only one occurring in a woman, and this was not recognized before operation. Most of the patients had reached old age, more than one-third were in the seventh decade of life, and only 20 per cent were less than fifty years of age. Most of the diverticula were adjacent to the ureteric orifices; 10 were near the right orifice, 8 near the left. Four occurred in the midline behind the interureteric bar, 6 in the vault and one on each lateral wall.

Frequency of urination was the most common symptom. Difficulty in starting the stream, and burning and smarting on urination were also nearly always present, though often intermittent. Hematuria occurred in 15 cases, but 8 of these had an associated calculus or tumor of the bladder. In other cases the bleeding was usually small. Seven cases complained of pain, usually accompanying urination, varying from slight, dull suprapubic pain to terrific spasms in which the patient would sit on a chair and rock back and forth violently while voiding. Cloudy and foul smelling urine occurred in 15 cases, in 8 there was a mild cystitis, and in 7 the urine was practically clear.

In most of the cases the kidneys functioned well, as judged by the output of phenolsulphonphthalein and the determination of the blood urea nitrogen; in only 7 cases was the output of phthalein less than 30 per cent in two hours (intramuscular method). One case entered the hospital with uremia. Only 4 cases lacked evidence of hypertrophy of the prostate, or of contraction of the vesical orifice. Calculi were found in 8 of the 31 cases; in 4, the calculus was found in the diverticulum, and in the other 4, it was free in the bladder. One case was unusual in that seven large stones lay directly on a carcinoma which involved nearly the whole floor of the bladder and part of the left ureteral wall. Neoplasm of the bladder was present in 7 cases. One case showing a benign papilloma with diverticulum at operation, eight years later died from an extensive sloughing carcinoma of the bladder. Thus a benign growth should be regarded at least as potentially malignant.

Twenty-five cases were operated upon. Preliminary drainage was employed, usually through a urethral retention catheter. First stage cystostomy was avoided, and when the patient's condition became satisfactory, the bladder was opened suprapubically and the diverticulum was packed with gauze, the adjacent pelvic tissues were dissected from the outer wall of the bladder in the region of the diverticulum, the sac was defined, and then narrowed down to its neck which was cut through, the wall of the sac was removed, and the edges of the wall of the bladder were united with one or two rows of interrupted catgut. If the sac was small, the entire wall of the diverticulum was inverted, and after cutting across the neck, the repair was made from the bladder aspect, thus eliminating the pelvic dissection. If the preoperative drainage had been sufficiently long, it was possible to enucleate a small prostate at the time the diverticulum was excised.

Difficulties of operation are firm and extensive pelvic adhesions, and cases in which the diverticula grow from the more dependent portions of the bladder. Relief from symptoms was uniformly gratifying.

Roentgenography of the bladder has greatly simplified the diagnosis of diverticulum. The introduction of an opaque medium into the bladder, followed by a single negative roentgenogram, by no means rules out the presence of a diverticulum. Partial removal of the medium may show a sac clearly outlined. Lateral views as well as anteroposterior ones should be taken, to show the complete relations of the sac.—*R. S. Bromer.*

VALENTI, ALESSANDRO. A case of Ewing's tumor. *Radiol. med.*, Feb., 1929, xvi, 182–190.

A case of solitary diffuse endothelioma or Ewing's tumor is described in a boy aged twelve, occurring in the midportion of the diaphysis of the right femur. There was a remarkable response following irradiation (100 per cent S.U.D.). In connection with this the different diagnostic signs of Ewing's tumor are discussed.—*T. Leucutia.*

Vallebona, Alessandro. Bone alteration in tabes dorsalis, arthropathy and tabetic spondylitis. *Radiol. med.*, May, 1929, xvi, 500–527.

According to Hesse in 5 to 10 per cent and according to Marie in 4 to 5 per cent of all cases of tabes dorsalis, articular lesions of some sort are demonstrated. The author by a systematic roentgenologic examination of all cases of tabes dorsalis coming under his observation was able to discover arthropathic and spondylitic lesions in 3 cases in which there was no clinical evidence of manifest lesions. The first case was that of a spondylitis deformans localized to the dorsal spine, the second that of an arthritis deformans of the knee and the third that of a beginning arthritis deformans of the coxofemoral articulation.

In analyzing the type of changes produced both in the articulations and on the bones, the author arrives at the conclusion that the deformations are somewhat similar to those found in arthritis deformans or in other bone alterations resulting from the direct neurotrophic action of the nervous system (syringomyelia, para-arthropathies of paraplegias, muscular and connective tissue calcifications observed in various nervous diseases such as progressive myositis ossificans and traumatic myositis ossificans, transverse myelitis, ostiosis neurotica para-articularis and paraossalis, etc.). From this he deducts that tabetic arthropathy must likewise represent a condition secondary to the neurotrophic action of the nervous system.—*T. Leucutia.*

Vietti, Marco. The roentgenologic syndrome in acute and chronic pararenal infections. *Radiol. med.*, June, 1929, xvi, 611–629.

The following roentgenologic signs of pararenal infections are more or less important: (1) obscuration of the kidney; (2) abnormal pararenal shadows due to abscess formations or calcifications; (3) fixation of the kidney; (4) disappearance of the psoas outline; (5) visualization of the adipose capsule; (6) vertebral scoliosis opposite the lesion; (7) fixation of the diaphragm; (8) disappearance of the normal contour of the muscles of the abdominal wall.

In the more obscure cases as well as in the so-called appendicitic forms (chronic metaappendicular hypochondrocellulitis) the clinical examination is more conclusive.

Several cases are illustrated with roentgenograms and the conclusion is reached that while the roentgen findings are of considerable value in the clear cut cases of acute and chronic pararenal infections, an association with clinical examination is of more help in the obscure cases.—*T. Leucutia.*

Will. Hysterosalpingography as an adjunct to methods of examination in gynecology. *Deutsche med. Wchnschr.*, Feb. 8, 1929, lv, 222–224.

The author has employed hysterosalpingography for a period of a year and a half with satisfactory results. The method is especially indicated: (1) as a control of the findings of bimanual examination; (2) for the demonstration of tubal sterility; (3) for the diagnosis of extrauterine pregnancy; (4) for the differential diagnosis between submucous and intramural myomas; (5) for the differential diagnosis between the tumors of the uterus and adnexa, and (6) for the demonstration of developmental anomalies of the uterus.

Contraindications are: (1) heart disease; (2) acute inflammations of the uterus and adnexa, including gonorrhea; (3) uterine bleedings; (4) former intrauterine interventions; (5) pregnancy.

The following signs are of diagnostic value in the different conditions: Pregnancy: rounded or oval form of the uterus due to diminishing of the tonus; filling defect caused by the presence of the ovum.

Extrauterine pregnancy. (1) Passage disturbance of one of the tubes with enlargement of its outer third by patency of the opposite tube; (2) flaccidity of the uterus similar to that observed in pregnancy but without the evidence of filling defect.

Submucous Myoma. Deformity of the uterine cavity, filling defect at the place of the myoma.

Intramural Myoma. Asymmetry of the entire uterine cavity, deformation and enlargement of the uterine lumen.

Uterine Carcinoma. Deformity of the uterine cavity with filling defect of irregular margins, the entire appearance being clouded and blurred.

Occlusion of Tubes. Lack of injection of the tubes or part of the tubes.

Sactosalpinx. Normal or only slight enlargement of the tube in the first and second third and very marked enlargement with caving in of the distant third.

Tumors of the Adnexa. None of the contrast medium enters the abdominal cavity, there being an occlusion of the tubes with eventual enlargement of the lumen of the tubes.

Ovarian Tumors. Diagnosis is chiefly by exclusion and in the presence of positive palpation findings.

Polyps and placental residues are evidenced

by the presence of filling defects of various sizes. A few cases are presented with illustrations of roentgenograms.

The conclusion is reached that hysterosalpingography forms an important adjunct in gynecological examinations.—*T. Leucutia.*

Zanelli, Arturo. The roentgenographic projection of the temporomandibular articulation. *Radiol. med.*, May, 1929, xvi, 495–499.

Two positions are recommended for the projection of the temporomandibular articulation: (1) straight lateral, and (2) lateral oblique submaxillary (Maj). In the straight lateral position the head of the patient is angulated 30° to the longitudinal axis of the body so that the incidence of the rays will be through the submaxillary region. In the lateral oblique submaxillary position, which was first described by Maj, the patient is placed face downward with the forehead and nose obliquely on the film and the tube is inclined posteriorly (caudocranially) 30° so that the incidence of the rays will be in the occipitofrontal direction. In both instances use is made of the Potter-Bucky diaphragm. The author reports a slight modification of the lateral oblique submaxillary projection of Maj in that the patient is advised to inflate the oral cavity during the course of the exposure so as to produce a better contrast of the articulation on the film.—*T. Leucutia.*

ROENTGEN AND RADIUM THERAPY

Balestra, Giovanni. The radiation therapy of mixed parotid tumors. *Radiol. med.*, June, 1929, xvi, 574–583.

Three cases of mixed parotid tumors which have been treated by irradiation are described in detail. In the first case, that of a man sixty-two years of age, the application of combined roentgen and radium therapy led to a disappearance of the lesion lasting for a period of two years (the patient died from a cerebral hemorrhage). In the second case, that of a woman sixty-seven years of age, the application of roentgen therapy alone led to considerable reduction in the size of the tumor lasting for a period of eighteen months. In the third case, that of a girl nineteen years of age, the treatment is not as yet completed.

The conclusion is reached that radiation therapy is of considerable aid in the treatment of mixed parotid tumors, leading in some instances to entire disappearance of the tumor and in others to reduction in size with clinical improvement. By taking into consideration the possible complications of surgical intervention (facial paralysis, salivary fistula, etc.) one is justified in applying radiation in all cases of mixed parotid tumors as a primary method of treatment.—*T. Leucutia.*

Beck, A. Growth injuries following therapeutic roentgen irradiation. *Strahlentherapie*, 1929, xxxii, 517–533.

Seven cases are described (and illustrated with photographs and roentgenograms) in which intensive irradiation during the period of adolescence led to rather marked growth disturbances. In contradistinction to Hueck who considers the growth disturbances merely as secondary manifestations of the disease itself, the author expresses the opinion that they are the result of roentgen injury. No such disturbances were observed in the cases in which milder irradiation was used.—*T. Leucutia.*

Bolaffio, M., and Bompiani, R. Experiences with mild irradiation of the ovaries. *Strahlentherapie*, 1929, xxxii, 465–488.

Forty-four cases were treated at the Gynecologic Clinic of Rome with mild irradiation over the ovaries for the following conditions: (1) primary functional disturbance; (*a*) amenorrhea—5 cases; (*b*) severe cyclic disturbances (spanio-menorrhea)—9 cases; (*c*) light cyclic disturbances (opsomenorrhea)—9 cases; (*d*) hypomenorrhea—4 cases; (2) functional disturbances on a tuberculous base—6 cases; (3) secondary functional disturbances; (*a*) amenorrhea—5 cases; (*b*) cyclic disturbances—5 cases; (*c*) hypomenorrhea—1 case.

In connection with the above tabulation the authors call attention to the confusion existing in the nomenclature of oligomenorrhea and polymenorrhea. They believe that a distinction should be made between the disturbances in quantity (hypo-and hypermenorrhea) and in the cycle (proio-, opso- and spaniomenorrhea) of the menstruation.

The following results were obtained: (1) of the primary disturbances, in amenorrhea, healing was obtained in 3, no result in 2; in spaniomenorrhea, healing in 6, improvement in 2, no result in one; in opsomenorrhea, healing in 6, improvement in 2, no result in one; in hypomenorrhea, healing in none, improvement in one, no result in 3. (2) In the disturbances on a tuberculous base (6 cases) no results were obtained. (3) Of the secondary disturbances, in amenorrhea healing was obtained in one and no result in 4; in the cyclic disturbances, healing in 2, no result in 3 and in

the one case of hypermenorrhea there was improvement.

The results were tabulated also according to the age of the patient, and it was found that with increased age there is a decrease in the percentage of the healings and improvements. The hypo- and dysmenorrhea showed in all instances a lesser response towards irradiation, indicating that some organic disease of the genital organs must be the underlying cause. Thirteen of the 44 cases treated have become pregnant (some of the cases twice, for a total of 19 pregnancies). Eight pregnancies came to term, entirely normal babies having been delivered. Two other pregnancies are following a normal course and in 9 there was a miscarriage. Eight of the offspring were observed, some for a period as long as four years and there was no evidence of developmental disturbance.—*T. Leucutia.*

Chizzola, Giuliano. First year of activity of the Radium Therapeutic Service. *Radiol. med.*, April, 1929, xvi, 390–415.

The author discusses the activity of the Radium Therapeutic Service at the Civil Hospital in Udine (which owns 202.02 mg. of radium bromide salt) and describes in detail the arrangement and working methods of the department. Fifty-three cases of malignancy were treated during the first year. The immediate results obtained are very encouraging.—*T. Leucutia.*

Dean, Archie L., Jr. Epithelioma of the penis; treatment with radium and the roentgen rays. *Arch. Surg.*, April, 1929, xviii, 1273–1279.

This paper is a clinical study of 75 cases of epithelioma of the penis from the Department of Urology of the Memorial Hospital, New York. The ages of the patients ranged from twenty-one to seventy-nine years; 70 per cent were married, 11 per cent were widowers and 19 per cent were single. Nine per cent were negroes and the remainder were white persons. No Jews appeared in the series. The presence of syphilis was admitted or proved in 20 per cent and 2 per cent had suffered with chancroid; 24 per cent admitted they had had gonorrhea.

The outstanding factor in the causation of penile cancer is a tight prepuce, which is difficult or impossible to retract, and for this reason the disease is never seen among Jews or Mohammedans. In the series there was no record of a case of epithelioma of the penis developing in a man circumcized in infancy. Syphilitic ulcers and scars are mentioned frequently as of etiologic importance. Leucoplakia is recognized as a precancerous lesion, papillomas of the penis have been known to undergo cancerous degeneration, and accidental trauma of various degrees of violence has been described as a contributing cause. In Dean's experience these factors have seemed to be of but secondary importance.

The first symptom noticed in 73 per cent of the cases was a small sore on the penis, the most common site being somewhere on the glans. As the disease progressed the lesion increased in size, and in 58 per cent of the cases pain developed. Other symptoms were aching, stinging, sharp and burning sensations, itching, bleeding, difficult urination, frequency of urination, and paraphimosis.

The two clinical varieties of epithelioma of the penis are the papillary and the flat lesions. The former is cauliflower-like in appearance, and consists of densely matted villous overgrowth, and is characterized by broadness of its base in relation to its height and thickness. The flat carcinoma is usually an indurated area with an ulcer of irregular outline in its center. Both types are squamous carcinomas. Each type spreads by progressive involvement of contiguous structures. While at the same time it excavates more deeply, Buck's fascia, owing to its dense consistence, is a natural barrier. When this structure has been penetrated, at the Memorial Hospital, the prognosis is promptly said to be more grave and the type of treatment is altered. Metastases occur by embolism. Lymphatic permeation is believed to be a later stage, in which cancer emboli, caught somewhere in the lymph-channel, grow in the directions of least resistance. Metastasis occurs rather late in the disease. The superficial areas of the penis are drained by lymphatics which communicate with nodes in the groins, thus inguinal nodes are examined for earliest metastases.

The diagnosis should be made histologically. A biopsy made with a sharp razor does little if anything toward hastening metastasis. The prophylactic treatment of epithelioma of the penis consists in the circumcision of all male infants. Only intense irradiation is effective because squamous carcinoma is highly radioresistant. For this reason radium applicators only are used at the Memorial Hospital in dealing with the primary lesion. The groins of all patients who present regional adenopathy are treated as a routine with high voltage roentgen rays, employing an exposure of 320 ma-min., a focal distance of 50 cm., a spark gap of 90 mm., filtration of 0.5 mm. of copper and 1 mm. of aluminum, and 200 kv.

If the primary lesion is 2 cm. or less in diameter, superficial, and metastases cannot

be detected, the tumor is treated by a radium plaque, the dose being 1,200 mc-hr. per square centimeter, at 1 cm. distance. The plaque is a box 1 cm. square which contains radium emanation enclosed in silver capsules, the walls of which are 0.5 mm. in thickness. The side of the box which overlies the tumor is made of brass, 1 mm. in thickness.

If the primary tumor is larger than 2 cm. in diameter and metastases are not found, the treatment of choice is usually irradiation with the plaque followed in from three to four weeks by a conservative amputation.

In the third group of cases the patients had both a primary lesion and metastases when first seen. These patients received the above-mentioned dosage of roentgen rays and in addition, a radium pack exposure of 9,000 mc-hr. at a 6 cm. distance, filtered through 0.5 mm. of silver and 1 mm. of brass. At the end of three to four weeks a block dissection was performed, or if a reasonable amount of regression was noted, treatment by irradiation only was carried on. In those patients whose powers of resistance were seriously depleted by age, disease or both, no inguinal dissections were performed.

In the fourth or last group of cases 9 patients were referred for postoperative irradiation only.

Conclusions. 1. The results obtained with the use of radium applications alone have been highly satisfactory in those cases of epithelioma of the penis in which the tumor was 2 cm. or less in diameter and reasonably superficial.

2. With more extensive tumors, surgical measures are necessary, and irradiation is a useful adjunct.

3. Radical extirpation of the penis in every case of epithelioma is unnecessary. A conservative amputation effectively removes the disease and frequently preserves function.

4. Secondary infection of the regional lymph nodes, which occurs regularly in the presence of a sloughing penile tumor, is a grave complication to either surgical or radiation therapy.

5. Present methods of irradiation are inadequate to check the metastases of squamous carcinoma in the presence of secondary infection.—*R. S. Bromer.*

DUHEM, P., and AIDAN. Radiotherapy in crisis of suffocation of infancy. *J. de radiol. et d'electrol.*, May, 1929, xiii, 273–276.

Four conditions are responsible for crises of suffocation in infants: hypertrophy of the thymus, congenital stridor, laryngeal spasm and mediastinal tumor.

The hypertrophy of the thymus may occur either alone or in conjunction with a general hypertrophy of all lymphoid tissues. In both instances roentgenologically there is an enlargement of the upper mediastinal shadow. A differentiation from tracheobronchial adenopathy is often difficult.

Congenital stridor (which is a condition of the first days of life) is characterized by a wheezing inspiration without cyanosis and secondary dilatation of the veins. Roentgenological examination as a rule is negative and the condition usually clears up spontaneously.

Laryngeal or glottis spasm is an affection which may become very serious. It occurs in infants of from two to fifteen months of age and it manifests itself either in light or severe attacks. The pathogenesis of the lesion is not completely elucidated; while some authors are inclined to believe that it is a condition due to hypertrophy of the thymus, others consider it as a secondary manifestation to rickets, gastrointestinal auto-intoxication, etc., and again others as a symptom of tetany or spasmophilia. The roentgen examination is negative, and the only positive sign is a faradic and galvanic hyperexcitability.

Tumors of the upper mediastinum produce an intense dyspnea, cyanosis and a very alarming general condition.

Roentgen therapy is the method of choice in the treatment of hypertrophy of the thymus. In congenital stridor, as well as laryngeal spasm, occasionally a clearing up of the condition is observed following irradiation, therefore roentgen therapy is indicated but it should always be combined with other methods of treatment (ultraviolet radiation, warm hydrotherapy, internal medication, etc.). In case of mediastinal tumor, roentgen therapy may be attempted though the condition is invariably hopeless.

Of 18 cases of hypertrophy of the thymus treated by the author a complete healing was obtained in 12 cases. In 3 cases the results were questionable and 3 others died (one from bronchopneumonia, one from pulmonary tuberculosis and one from sudden death).—*T. Leucutia.*

DYROFF, RUDOLF. The histological regression of uterine carcinoma after roentgen irradiation. *Arch. f. Gynäk.*, March 20, 1929, cxxxvi, 141–166.

After a rather detailed review of the literature dealing with the histological changes of carcinomas following irradiation, the author presents the results of his own investigations which were carried out in carcinomas of the uterus by taking not more than two biopsies in

each individual case. The first biopsy was taken previous to the irradiation and the second at different intervals following irradiation.

The conclusion is reached that the effect of the roentgen rays on the carcinoma is direct and through a primary injury of the cells (chiefly of the chromatin) and that the secondary action on the neighboring tissues leading to fibrosis and cicatrization becomes manifest only four weeks following irradiation and lasts for a period of several months.—*T. Leucutia.*

Ffrrari, Paolo. Neoplasm developing on the base of a severe radiodermatitis following ultraviolet irradiations. *Radiol. med.*, March, 1929, xvi, 298–300.

A case of neoplasm is described (in a woman fifty years of age) which developed on the base of an old radiodermatitis following the application of ultraviolet radiation. The lesion is interesting since it represents the only case in the literature known to have developed as a result of ultraviolet radiation.

The conclusion is reached (1) that ultraviolet radiation has certain limitations, especially in the application to roentgen-ray injuries, and (2) that, therefore, it must be used according to well defined biological-clinical indications and with maximum precaution.—*T. Leucutia.*

Floris, Michele, and Businco, Ottavio. Roentgen therapy of the pituitary in alterations of the menstrual function. *Radiol. med.*, May, 1929, xvi, 474–492.

After a brief review of the literature and a short résumé of the animal experiments (the experiments of del Buono, Revoltella and Podljaschuk having been discussed in somewhat lengthy detail), the author presents his own clinical results in 15 cases of menstrual disturbance which were treated by irradiation of the pituitary gland during 1925–1928. Of the cases treated one was that of a genital hypoplasia with hypomenorrhea, one a secondary amenorrhea, one a hypomenorrhea with secondary amenorrhea of five months' duration, one a primary amenorrhea of twenty-five years' duration, 3 preclimacteric menorrhagias, 5 hypermenorrheas in mature women, one a hyper- and polymenorrhea in a mature woman and 2 menorrhagias of puberty.

In all instances (following roentgenoscopic localization of the sella) $\frac{1}{10}$ S.U.D. was administered over each temporo-occipital and over the frontal regions (3 areas) by using the following technique: Symmetry apparatus, 40 cm. spark gap, 23–30 cm. skin target distance, 0.5 mm. Zn plus 4 mm. Al filters, 2 ma., fields 4 × 6 cm. In 6 cases, the irradiation was given once and in the other 9 cases it was repeated one month later.

The results obtained were very satisfactory. Except in the 2 cases of primary amenorrhea and the one case of hyper- and polymenorrhea (in this latter the result was of only temporary duration) the menstrual alterations disappeared in all instances.

The conclusion is reached that irradiation of the pituitary gland with small doses is of considerable value in menstrual disturbances of both the hyper- and hypofunctional type. The action of the roentgen rays is most probably stimulative through increased activity of the pituitary gland as a whole. This leads to a double effect on the genital organs: while the increased secretion of the anterior lobe of the pituitary acts directly on the ovarian follicles modifying the activity and rhythm of the ovulation and menstruation, the increased secretion of the posterior lobe stimulates the tonicity and thus controls the hemostatic function of the uterine muscles.—*T. Leucutia.*

Gertz, Willy. Attempt to influence ulcer by borderline rays. *Strahlentherapie*, 1929, xxxii, 489–504.

Following the method of Bucky, the author treated 5 cases of gastritis and 12 cases of gastric and duodenal ulcer during 1926 and 1927 by the application of borderline rays. Later some other cases were added so that the total number of cases treated now reaches 50. The treatment was undertaken on the assumption that the borderline rays produce an influence on the autonomous nervous system of the skin resulting in a reflectoric effect on the splanchnic system.

The method of irradiation was as follows: In a first series, all patients were hospitalized and placed on a rigid Sippy diet. The irradiation with borderline rays was carried out between 11 and 12 o'clock over the upper abdominal region, with 10 kv., 10 ma., 10 cm. distance, $\frac{1}{3}$ S.U.D. (1 S.U.D. amounting to 18 minutes) three times at two day intervals. Following a period of four days' rest the same dose was repeated over the upper abdomen posteriorly.

In a second series, the irradiation was carried out with $\frac{1}{2}$ S.U.D. on consecutive days for 460 R (over the upper abdomen anteriorly and posteriorly), the treatment being repeated after an interval of four days. In this series a rather large number of ambulatory patients were treated.

The total leucocyte count showed a decrease within five minutes following each irradiation, lasting for a period of five to ten minutes after

which there was return to normal. Following further irradiations there was a more permanent decrease, occasionally a value as low as 50 per cent of the original count having been obtained. Parallel with this decrease in the leucocytes there was a gradual disappearance of the pain with very marked general improvement.

The history of 23 cases is briefly given. The conclusion is reached that while deep roentgen therapy often produces an improvement and occasional healing in gastric and duodenal ulcers (without, however, always relieving the pain), the chief value of the borderline ray therapy lies in the rapid relief of pain.—*T. Leucutia.*

GRIES, KARL. Contribution to radium therapy. *Zentralbl. f. Gynäk.*, March 30, 1929, liii, 797–799.

The value of radium compresses in ischias, lumbago, rheumatic diseases and chronic joint affections is well known. The author applied radium compresses (of the Allgemeine Radium-Aktien-Gesellschaft, Berlin) also in subacute and chronic adnexitis and parametritis with very satisfactory results. The improvement as a rule starts within three to four days following the application of the compresses and lasts for rather long periods.—*T. Leucutia.*

HINTZE, ARTHUR. The improvement of the operative results in breast cancer following postoperative irradiation. *Klin. Wchnschr.*, April 2, 1929, viii, 644–646.

The author criticizes the statements of Jüngling with regard to the inefficacy of postoperative irradiation in carcinoma of the breast, and presents his own results over a period of ten years (1913–1923) which include a series of over 900 cases.

Between 1913 and 1919 the irradiation was carried out (by Kobelt) with the fractional method by administering a daily dose of 1/10 S.U.D. for a period of twelve to fourteen days until redness of the skin was obtained, treatment being repeated after an interval of several weeks. Between 1920 and 1923 the technique of massive radiation (deep roentgen therapy) was used with full doses (100 per cent S.U.D.) repeated at two months' intervals for a total of three series. In connection with the application of deep roentgen therapy, special emphasis is laid on the tangential irradiation for the prevention of severe intrathoracic injuries which in the author's estimation are responsible for many of the unfavorable results reported by other investigators.

Of the 900 cases, 834 (92 per cent) were followed up; 587 were treated by operation alone (177 of these cases being irradiated later for recurrence), and 247 by operation and postoperative irradiation. The results in the irradiated cases were improved with from 50 to 100 per cent which in view of the fact that only the more advanced cases were submitted to irradiation is a remarkable accomplishment. A comparative tabulation shows that of the irradiated cases 69.3 per cent were well at the end of three years; 55.9 per cent at the end of five years; 33 per cent at the end of ten years and 29.2 per cent at the end of fourteen years, while in the cases treated by operation alone only 51.3 per cent were well at the end of three years; 35 per cent well at the end of five years; 20.8 per cent at the end of ten years and 15.3 per cent at the end of fourteen years. The author then compares his results with those of other investigators (who used chiefly operation alone) as well as with those left untreated, and arrives at the final conclusion that postoperative irradiation is of considerable aid in the treatment of mammary carcinoma. This is especially important in view of the fact that comparative statistics of the clinics of Berlin (Bier), Kiel and Tübingen show that only 5 to 10 per cent of the total carcinomas of the breast coming under observation belong to Stage I, while 70 per cent belong to Stage II and 19 to 32 per cent are inoperable, and as is known roentgen irradiation is of greatest benefit in the cases with regional extensions.—*T. Leucutia.*

HOLST, LEOPOLD, and KAPLUNOWA, D. Therapy of bronchial asthma by irradiation of the spleen. *Strahlentherapie*, 1929, xxxii, 505–516.

After a rather detailed review of the literature, the author presents his own results (6 of the cases being briefly described) of irradiation of the spleen in bronchial asthma (in a total of 57 patients).

The technique used was as follows: Radiotransverter (Koch and Sterzel), 23 cm. skin target distance, one area over the spleen anteriorly, 0.5 mm. Cu plus 1 mm. Al, 165 kv. (measured on a voltmeter), 2 ma., 30 minutes, 1/2 S.U.D., treatment being repeated not sooner than three weeks and not more than three times.

Of the 57 cases treated 44 were followed up. In 38 of these (86 per cent) positive results were obtained. In a first group (11 cases, that is, 25 per cent) the results were splendid, a permanent healing lasting for a period of several years having been obtained. In a second group (27 cases, that is 61 per cent) the results consisted chiefly in a temporary improvement lasting from one to several months. No results were obtained in 6 cases.

The best results were obtained in the acute cases and in the cases responding with pronounced roentgen sickness. Occasionally a deterioration of the symptoms was observed for a period of two to three days after the irradiation which however was soon followed by marked improvement.

The conclusion is reached that roentgen therapy is a powerful asset in the treatment of bronchial asthma. The effect of the irradiation of the spleen consists in desensitization of the organism against allergin. Since the etiology of asthma is very manifold it is only natural that in the cases with other causes irradiation of the spleen should remain without effect. In such instances subsequent irradiation of the lungs, hilar glands, cervical glands, and in rare instances thymus or thyroid may prove of benefit. A literature of 48 references is appended.—*T. Leucutia.*

Kingreen, O. The roentgen therapy of tumors, especially sarcomas, of the vertebral column. *Arch. f. klin. Chir.*, April 25, 1929, clv, 283–288.

Eight cases of multiple carcinoma metastases to the spine and one case of sarcoma metastasis were treated during the past three years. The one case with sarcoma metastasis, that occurring in a girl sixteen years of age, is described in detail. Roentgen therapy has led to marked improvement lasting for a period of over two years.—*T. Leucutia.*

Lacassagne, A. The relative importance of the causes of success or failure in radiotherapy of collum epithelioma. *Strahlentherapie*, 1929, xxxii, 434–440.

The results in the radiotherapy of uterine carcinomas depend on four main factors: (*a*) Extension of the lesion. According to this the collum carcinomas are divided into: (1) operable; (2) borderline; (3) inoperable, and (4) extreme cases. Of 97 cases which were treated during 1925, 10 belong to (1), 21 to (2), 51 to (3) and 15 to (4). Healing (three years) was obtained in (1) in 78 per cent (7 out of 9, one case not having been followed up); in (2) in 45 per cent (9 out of 20, one case having died of intercurrent disease); in (3) in 50 per cent (25 out of 50), and in (4) in 6 per cent (one out of 15).

(*b*) Thoroughness of the treatment. If only those cases are taken into consideration which have completed the treatment the percentage of cures is as follows: In (1), 77 per cent (7 out of 9 cases); in (2), 72 per cent (8 out of 11 cases); in (3), 60 per cent (20 out of 33 cases), and in (4), 50 per cent (one out of 2).

(*c*) Influence of histopathological factors. The collum carcinomas are divided according to the histopathological appearance into squamous cell epitheliomas, transitional cell epitheliomas and adeno-epitheliomas. It seems that the histological appearance is of only secondary influence on the final results obtained by irradiation.

(*d*) Secondary infections. The most common factors preventing a thorough application of the treatment are the secondary infections. Since these infections always occur in the more advanced carcinomas it is in the cases belonging to (3) and (4) that our difficulties are the greatest. A preliminary treatment of the infection or at least a diminishing of its virulence is advised.

The conclusion is reached that radiotherapy when correctly applied is the most powerful agent in the successful treatment of carcinomas of the cervix.—*T. Leucutia.*

Lacassagne, A. The effect of the roentgen rays and of the gamma rays of radium on the blood vessels and their rôle in the regression of cancer. *Strahlentherapie*, 1929, xxxii, 441–444.

1. Blood Vessels. The question of whether the action of roentgen rays on cancer is by means of a primary effect on the cancer cells themselves or through a secondary reaction brought about by the changes in the blood vessels for a long time has formed a favorite topic for discussion. It is now almost generally admitted that the death of the germinating layer of the epidermis precedes the changes of the blood vessels. The reasons why a direct cytolethal action of the roentgen rays should be considered as the underlying cause of all radiation effects are according to the author's estimation: (1) that cytologic changes occur immediately and certainly previous to blood vessel changes in most carcinomas; (2) that all experiments to produce a regression of the carcinoma by means of ligation of the blood vessels shutting off the blood supply have failed; (3) that cytologic changes (such as seen following irradiation of carcinoma tissues) are experimentally observed also after irradiation of apparently normal tissues (neuro-epithelium of chicken embryos, etc.), and (4) that the radiosensitivity of the blood vessels and especially of the endothelial lining of the blood vessels is far from being so general and so pronounced as claimed by some of the observers.

11. Lymph Vessels. That roentgen rays are able to influence the lymph vessels and the lymph circulation is beyond doubt. The best proof for this is the often observed edema

(a result of occlusion of the lymph capillaries of the corium) and the scleroderma which appear following heavier irradiation. It is possible that both of these changes may be simple manifestations of the effect of roentgen rays on the connective tissue but they certainly play a great part in the localization of the carcinoma through destruction of the lymphatic capillary system.—*T. Leucutia.*

MARKL, J. Microenergetic applicator. *Strahlentherapie*, 1929, xxxii, 589–596.

The analgetic and antirheumatic action of radium emanation (in the form of drinking water or bath) as well as of radium in the form of compresses, applicators, etc., is beyond doubt. The Radiumchema Corporation constructed radioactive compresses of very small doses (10 × 15 cm. and 15 × 20 cm. in size and containing 6.3×10^{-3} mg. up to 6.3×10^{-2} mg. Ra) which the author has used to great advantage in cases of rheumatism, neuralgias, arteriosclerosis and disturbances of metabolism. Five cases are briefly described in which good results have been obtained by the application of the compresses.

The effect is most probably chemical through the action on the biocolloids within the diseased area.—*T. Leucutia.*

PALUMBO, V., and DE MAYRHAUSER, P. Observations on the importance of dosimetry of roentgen rays in superficial therapy. *Radiol. med.*, June, 1929, xvi, 606–611.

There is no classical or standard dose in superficial therapy. The total dose differs from one region to another according to the thickness of the fatty tissues. A dose which would epilate the hairy scalp, for example, would be excessive if applied on the thorax and would lead to pigmentation.

The difference in action is the more pronounced, the more one reduces the tension of the tube, the filtration and the time of exposure and the more one increases the milliamperage. The size of the field does not play such an important rôle as in deep therapy.—*T. Leucutia.*

PERUSSIA, FELICE. Radium therapy at a distance. *Radiol. med.*, April, 1929, xvi, 357–377.

After a résumé of the fundamental principles of telecurietherapy, the author describes the different apparatus used for the practical application of distant radium therapy. The construction of the apparatus is based on two principles: (1) the multiple, small field applications, and (2) the one single large field application. To the first group belongs the apparatus of Kessler and Sluys, of Stenstrom and of Mallet and Coliez, while to the second belong the apparatus of Regaud, Forssell, Failla and Mayer and Cheval. The author constructed an apparatus of his own which occupies an intermediate position between the two. Thus while maintaining the principle of the large field irradiation three radium "packs" are used (by a suitable change of the stativ) for the cross-firing of the lesions at different depths. Each of the packs contains 200 mg. of radium element. In case of necessity the apparatus can be used as a single pack applicator with 600 mg. of radium element.

Exact measurements carried out in association with Asti by means of the Mallet iono-micrometer have shown that the depth dose can be varied according to the angulation of the three packs. All doses are expressed in Dominici units (D), 1 D corresponding to 100 mg.-hr. radium element.

Four isodose charts are included for the following measurements: (1) 600 mg. radium plaque (filtered with 1 mm. platinum and 1 mm. brass) used as a single field applicator at 9 cm. focal skin distance. This furnishes on the surface of the skin 0.358 D per hour (that is, 8.6 D per day) which means that in order to administer an epidermicide dose of 35 D (according to the definition of Regaud and Nogier) the total irradiation has to be 115 hours, or 4.7 days. Under such conditions 44 per cent of the dose reaches a depth of 5 cm. below the skin and 25 per cent of the dose a depth of 10 cm.

(2) 600 mg. radium element is divided equally into three plaques (of 200 mg. radium element each) and the plaques cross-fired with the center of convergence 5 cm. below the surface of the skin. This gives a daily surface dose of 5.46 D, or an epidermicide dose in 154 hours (6.4 days). A dose of 65 per cent reaches a depth of 5 cm. below the skin and 26 per cent a depth of 10 cm.

(3) The 600 mg. radium element is distributed the same as in (2) with the exception that the convergence of the beam is 10 cm. below the skin. In this case the daily surface dose is 4.1 D and the epidermicide dose is reached in 204 hours (8.5 days). The dose reaching 10 cm. below the skin is 48 per cent.

(4) The 600 mg. radium element is distributed the same as in (2) with the exception that the center of convergence of the beams is 28 cm. below the surface of the skin. This gives a daily surface dose of 3.17 D, and an epidermicide dose in 264 hours (11 days). The dose reaching 10 cm. below the skin is 34 per cent.

It is evident from the above figures that the

cross-firing by the application of three plaques has great advantages, especially for the deep seated lesions. Unfortunately, however, the method is not economical. By treating a neoplasm of the parametrium, for example, and by using two ports of entry, one from the front and one from the back, according to the figures in (3) a continuous exposure of 15 days would be necessary in order to administer a dose of 92 per cent 10 cm. below the skin. This means that the method can be applied only for experimental purposes. The Radium Institute of the University of Milan and of which the author is director, possesses a total of 1.5 gm. of radium of which, however, only 600 mg. are used for telecurietherapy. The cases treated so far have all been pelvic malignancies and the results have been very encouraging.—*T. Leucutia.*

RULLE, P. H. Late injury of the urinary bladder following radium therapy. *Zentralbl. f. Gynäk.*, Feb. 9, 1929, liii, 357–359.

A case of radium injury with perforation of both the vesicovaginal and the rectovaginal septum is described in a woman fifty-six years of age, who seven years previously had received 7200 mg-hr. mesothorium and 1200 mg-hr. radium for an extensive carcinoma of the cervix. The mesothorium was given in two series; the first series consisting of eight sittings (600 mg-hr. mesothorium per sitting, between Jan. 21, 1921 and Feb. 25, 1921) and the second of four sittings (600 mg-hr. mesothorium per sitting between May 25, and June 2, 1921). Later, two more sittings of radium (600 mg-hr. per sitting) completed the treatment. Two years and eight months following the irradiation a rectovaginal and seven years later a vesicovaginal fistula appeared both of which have persisted since. There can be no doubt that these fistulae represent late ulcerations due to the application of excessive radiation. The case is compared with that of Heidler, the only similar occurrence found in the literature.—*T. Leucutia.*

SCHUMACHER, PAUL. The combination of roentgen irradiation with intravenous dextrose injection. *Klin. Wchnschr.*, March 26, 1929, viii, 585–587.

Twenty cubic centimeters of a 25 per cent dextrose solution was injected intravenously in 50 patients with inoperable carcinomas (and a few sarcomas) previous to irradiation. Besides the increased response of the lesion towards irradiation, a remarkable improvement in the general condition of all patients so treated was observed. The roentgen sickness was reduced to a minimum and the irradiation reaction was supported with ease.

The author does not believe that the action of the dextrose on the carcinoma is specific since, according to the investigations of Jaroschka, irradiated carcinomas of the cervix contain an amount of dextrose which is three times higher than that of non-irradiated tumors and the addition of intravenous injections of dextrose does not seem to further increase this dextrose content of the irradiated tissues. It is more probable that the effect is a general one through the increased resistance mechanism of the organism.

The intravenous injection of dextrose also proved of considerable value in the treatment of lesions other than carcinoma, as for example in pituitary tumors, castration of adipose women, etc. It is advised, however, to be cautious in cases of secondary infections since dextrose may lead to exacerbation of these infections. In such instances it is wise to irradiate with smaller fractional doses.

The conclusion is reached that the preliminary intravenous injection of dextrose is of considerable aid in the irradiation of advanced cases of malignancy.—*T. Leucutia.*

STRASSMANN, PAUL. Radiation therapy of carcinoma of the cervix. *Strahlentherapie*, 1929, xxxii, 413–433.

Radium or mesothorium has been used by the author for the treatment of carcinoma of the cervix since 1913. More recently the radium treatment was combined with deep roentgen therapy. The method of application has undergone several modifications until now the following procedure is used: The first radium application is made against the portio so as to diminish the virulence of the infection. While previously an application lasted as long as sixteen to twenty-four hours, at the present time it never exceeds twelve hours (applied either during the day or night). The second radium application is made in the cervix three days and the third six days later and so on till a total of 2000–3000 ra-el-hr. is reached. Thus the entire treatment is spread over a period of two to three weeks, the patient being hospitalized during the entire course of the treatment. The bladder as well as the rectum is well protected (by hard rubber or metal plates) during the irradiation. Four weeks later a series of deep roentgen therapy is applied, the irradiation time consisting of six times eighteen minutes given at two to three days' intervals (skin target distance 30 cm., field 8 by 10 cm., 5 ma., 180 kv., 0.5 mm. Cu and 1 mm. Al as filters). Following the comple-

tion of the roentgen therapy the patient is discharged and then observed at three months' intervals. The treatment is repeated only in case of recurrence of the bleeding or further extension of the carcinoma.

The series includes 429 cases from 1913 to 1923, and 303 cases from 1924 to 1928. Of the 429 cases of the first period 358 were systematically followed up.

All carcinomas of the cervix were divided by the author into two main groups: (A) operable and (B) inoperable carcinomas. The borderline cases were included in the operable group. Thus of the total 429 cases treated during the first period 244 were classified as operable (57 per cent) and 185 (43 per cent) as inoperable.

(A) The operable group was subdivided into (1) incipient carcinomas (29 cases); (2) manifest carcinomas (103 cases), and (3) borderline or progredient carcinomas (112 cases). The five year cures were in (1) 64.3 per cent; in (2) 22 per cent and in (3) 17.4 per cent, or if the entire group is considered as a whole, 25.7 per cent. In the cases which succumbed, the prolongation of life was in (1) forty-eight months; in (2) twenty-eight months, and in (3) twenty-five months, or an average of thirty months (two and a half years) for the group as a whole.

(B) In the inoperable carcinomas only 4 per cent were cured at the end of five years. The average life duration of the rest of the inoperable carcinomas was sixteen months. The apparently less favorable results in the inoperable carcinomas are due to the fact that all the borderline cases were included in the operable group, while in practically all other statistics dealing with more favorable results the borderline cases were included in the inoperable group.

The conclusion is reached that radium and roentgen therapy forms the method of preference in the treatment of carcinomas of the cervix. An operation is performed only in the cases with secondary complications (myomas, tumors of the parametrium, prolapse, etc.).—*T. Leucutia.*

TURANO, LUIGI. Roentgen therapy of skin epitheliomas with Bordier's old method. *Radiol. med.*, June, 1929, xvi, 583–599.

In 1925 Girel published the results of 280 cases of skin epitheliomas treated successfully by a hypermassive radiation, which he called the method of Coste. The author found that a similar technique was advocated in 1905 by Belot (who used 25 H without filter and with rays of very low penetration) and especially by Bordier who in 1906 perfected the method. Therefore, the name of "Bordier's method" seems more justified.

Fifteen cases are presented which were treated by the author himself with very satisfactory results. The dose applied was as follows: spark gap, average of 18 cm. (never less than 15 cm.) no filter, 20 H (4 B) to 25 H (5 B) which corresponds to 3200 to 4500 R (Solomon).

The method is advocated since it (1) is entirely harmless, (2) leads to wonderful results and (3) is of great practical value.—*T. Leucutia.*

VALLEBONA, ALESSANDRO. Roentgen and radium therapy of bone tumors. *Radiol. med.*, Feb., 1929, xvi, 190–216.

After a short review of the literature, as well as a brief consideration of the physical and biological principles governing the response of the various bone tumors towards radiation, the author discusses the value of radiation therapy in the bone tumors according to (*a*) statistics; (*b*) individual case reports, and (*c*) various views of other authors. (*a*) A comprehensive study of the statistics is entirely impossible because of the different nomenclature used in different countries and by different authors. (*b*) The descriptions of individual cases show only very rarely cures of five years' duration, some of four and several of three year's duration. (*c*) The opinions of the different authors are very manifold. While some have obtained cures of from 10 to 30 per cent, others have found irradiation of little value.

In comparing radiation therapy with surgical intervention, the opinion is expressed that roentgen therapy should be used in all instances and not only in the cases where surgery has failed or could not be applied.

The technique of irradiation and especially the relation between radium and roentgen therapy is briefly described. Several cases treated at the Radiological Institute of Florence are presented: (1) a case of osteosarcoma of the femur in a boy aged three, which following irradiation showed remarkable improvement for a period of two years but which later recurred, further irradiation being of no avail; (2) an osteoclastic tumor of the ilium with complete regeneration of the bone and reestablishment of normal health for a period of two years; (3) an osteoclastic sarcoma of the ischiopubic bones which was transformed by irradiation into a hard mass remaining stationary for a period of two years; (4) six cases of metastatic tumors to the bones are chiefly mentioned in which roentgen therapy

was of more or less beneficial value. The conclusion is reached that radiation in bone tumors may result in (1) arrest of the tumor; (2) more or less temporary regression of the neoplastic mass according to the relation in the cellular portions and stroma; (3) frequent regeneration of the destroyed bone; (4) production of excessive bone; (5) modification in the structure of the neoplasm leading to sclerosis; (6) prolongation of life, and (7) mitigation of symptoms.

The author also considers the value of radiation therapy in globocellular and fusocellular sarcomas expressing the opinion that the fusocellular sarcomas are more radiosensitive than the globocellular. In the giant cell tumors the results are often very satisfactory. In Ewing's tumor the immediate response is so pronounced that it is directly of differential diagnostic value.

The general conclusion is reached that roentgen therapy is of considerable aid in the treatment of the primary tumors of bone as well as in some cases of secondary metastasis. The article is richly illustrated with roentgenograms and a literature of 60 references is appended.—*T. Leucutia.*

Voltz, Friedrich. Radiation therapy in carcinoma of the uterus. Statistical investigations of 1500 cases. *Arch. f. Gynäk.*, April 24, 1929, cxxxvi, 213–228.

One thousand five hundred and forty-two cases of uterine carcinomas (1448 collum carcinomas and 94 corpus carcinomas) were treated between 1913 and 1923 at the University Clinic of München.

(A) Of the 1448 collum carcinomas 1319 cases were followed up. Of these, 227 (17.2 per cent) belong to Group I (operable cases); 310 (23.6 per cent) to Group II (borderline cases); 543 (41.2 per cent) to Group III (inoperable cases), and 239 (18 per cent) to Group IV (incurable cases).

Group I. Of the 227 cases in this group, 92 cases (40.5 per cent) were healed; 94 cases were treated by radium alone with a healing of 39.3 per cent and 130 cases by a combination of radium and roentgen rays with a healing of 41.5 per cent. Forty-four cases did not complete the irradiation and none of these were cured. If these cases are deducted, the percentage of relative cure increases from 40.5 to 50.2 per cent.

According to age incidence, the cure between thirty-six and forty-five years was 48.5 per cent (the highest), and between twenty and thirty-five years, 28.5 per cent (the lowest). According to social position, in the well-situated class (32) there was a healing of 46.8 per cent and in the poorly situated class (159) of 39.4 per cent.

Group II. Of the 310 cases in this group, there was healing in 69 (22.3 per cent). In 129 cases radium alone was applied with a healing of 20.9 per cent and in 170 cases combined radium and roentgen therapy with a healing of 23.5 per cent. Fifty-nine cases did not complete the irradiation, none of which have been cured. If these cases are deducted the relative cure increases from 22.3 per cent to 28.3 per cent.

According to age incidence the cure between thirty-six and fifty years was 24.7 per cent (highest) and between twenty and thirty-five years, 13.6 per cent (lowest). According to social position, in the well-situated class (29) there was a healing of 31 per cent and in the poorly situated class (281) there was a healing of 21.3 per cent.

Group III. Of 553 cases there was healing in 58 (10.7 per cent). In 281 cases radium alone was used with a healing of 8.9 per cent; in 236 cases the radium was combined with deep roentgen therapy with a healing of 13.1 per cent. According to age incidence, between thirty-six and fifty-one years, 10.1 per cent; between fifty-six and seventy-six years, 14.1 per cent, and between twenty and thirty-one years no cases were cured. According to the social position, in the well-situated class (35 cases) there was a healing of 28.5 per cent and in the poorly situated class (508) there was a healing of 9 per cent.

Group IV. Of 239 cases only 3 were cured.

The total cures in collum carcinoma are thus 222 cases out of 1319 cases, that is, 15.4 per cent. If the cases which did not complete the treatment are deducted the percentage increases to 18.2. The cures obtained by radium alone amount to 14 per cent and by the combination of radium and roentgen therapy to 21.4 per cent. According to age incidence the best results were obtained between the ages of thirty-six and fifty. According to social position, a cure of 32.6 per cent was obtained in the well-situated class while a cure of only 14.6 per cent was obtained in the poorer class.

(B) Of 88 cases of corpus carcinoma, there was healing in 36 cases (40.9 per cent). Forty-three cases were treated by radium alone, with a healing of 27.9 per cent and combination of radium and roentgen therapy was used in 42 cases with a healing of 54.7 per cent. According to age incidence the highest percentage of cures was obtained between forty-one and fifty-one years, which is 55.2 per cent.

Of 50 cases which were operable, cures were obtained in 33 (66 per cent) and of 38 cases

which were inoperable in only 7.9 per cent. Of the 50 operable cases, 28 were treated by combination of radium and roentgen rays with a healing of 78.5 per cent and 19 with radium alone, with a healing of 52.6 per cent.

The conclusion is reached: (1) that irradiation, especially in the form of combined radium and roentgen therapy is of considerable value in the treatment of both collum and corpus carcinomas. (2) The factors influencing the results are: (*a*) the method of treatment (combination of roentgen and radium therapy); (*b*) thoroughness of treatment (completion of the series); (*c*) age incidence (best results being obtained between thirty-five and fifty years), and (*d*) social position (the well-situated class showing a considerably higher percentage of cures). (3) Since all factors except the age incidence can be controlled, it is expected that with a gradual development of technique and general betterment of social conditions a further increase in the cures will be obtained.—*T. Leucutia.*

MISCELLANEOUS

BUSINCO, OTTAVIO. Experimental researches in radiotherapy of inflammatory processes. *Radiol. med.*, June, 1929, xvi, 600–606.

A series of experiments was performed on dogs inoculated with typhoid bacilli in order to determine the effect of the radiation on the course of the infection. The experiments were divided into three groups: (1) Eight animals which were inoculated on one flank were used as controls; 4 of the animals were followed up in order to study the normal course of the disease and 4 were sacrificed at one, two, four and seven days following the appearance of the abscess in order to note the microscopic changes. (2) Eight animals which were inoculated on one flank were irradiated following the appearance of the abscess. Four were followed up and 4 were sacrificed at one, two, four and seven days following the appearance of the abscess. (3) Four animals which were inoculated on both flanks were irradiated only on one side. Two were used as controls and 2 were sacrificed two to four days following the formation of the abscess.

The irradiation was performed with $\frac{1}{10}$ erythema dose (30 cm. spark gap, 4 mm. Al, 2 ma.). The following results were obtained: (1) In the animals in Group 1 the infection led within fifteen to twenty days to spontaneous healing. The same may be said of the controls of Group 3. (2) In the animals of Group 2 the abscess absorbed within five days following the irradiation (five to nine days following the formation of the abscess). (3) In the animals of Group 3 the irradiated abscesses healed within eight days following the irradiation while the abscesses on the opposite took twelve to fifteen days to disappear.

Histologically the favorable action of the roentgen rays resulted in a marked hyperplasia of the connective tissue (reticulo-histiocytes of the subcutaneous tissues) forming a mechanical barrier to the infiltrating and necrosing process.

The conclusion is reached that small doses of roentgen rays applied at the site of the primary focus lead to considerable shortening of the infection with typhoid bacilli.—*T. Leucutia.*

CASATI, ANNIBALE. Experimental investigations of the roentgen effect on the bone marrow. *Strahlentherapie*, June 5, 1929, xxxii, 721–738.

After a brief survey of the literature (in which the works of Heineke, Aubertin and Beaujard, and Siegel are especially emphasized), the author presents the results of his own experimentations on the effect of roentgen rays on the bone marrow.

In a first series of experiments the right posterior extremities of young rabbits were irradiated with 16 H = 800 R (150 kv. eff. 3 ma., 40 cm. skin target distance, 0.5 mm. Zn plus 2 mm. Al), the irradiation being administered on two consecutive days in doses of 8 H = 400 R each. The animals were killed ten, twenty and forty days following the irradiation and the bone marrow microscopically examined.

In a second series of experiments fourteen days following the first irradiation a second irradiation was given with 32 H = 1600 R.

In the preparation of the histological specimens the Kolmer method of fixation was used so as not to injure the nuclear structure.

It was found that degenerative changes of the bone marrow do not occur in rabbits until at least two weeks following the irradiation, a fact which is in contradistinction to the observation of other investigators. It is most probable that the changes which were described as occurring shortly following the irradiation were due simply to injuries of the cellular structure by the chemical substances used for fixation.

The degenerative changes observed following the irradiation consisted (*a*) in a differentiation of the myelocytes into cells with segmented nuclei and (*b*) in the differentiation of the myeloblasts into fibrocytes, this latter leading to the formation of connective tissue.

These observations explain not only the blood picture observed during the course of

irradiation of the bone marrow but also the formation of connective tissue in inflammatory and neoplastic conditions of the bone. In the cases where there is a tendency towards suppuration, the differentiation into pus cells with segmented nuclei leads to a shortening of the process, while in the cases with tendency towards cell proliferation, as for example in neoplasms, the irradiation leads to connective tissue formation and thus to encapsulation of the metastatic foci.

A bibliography of 73 references is appended.—*T. Leucutia.*

Clauberg, Carl. The Ruge-Philipp test in 200 carcinoma cases. *Zentralbl. f. Gynäk.*, May 4, 1929, liii, 1116–1119.

The virulence of the bacterial flora of 200 collum carcinomas was determined by means of the Ruge-Philipp test.

It was found that of 150 cases with a favorable Ruge-Philipp test, infectious complications resulted later in 10 cases (6.6 per cent), and of 50 cases with unfavorable Ruge-Philipp test infectious complications resulted in 14 cases (28 per cent). If all the complications, including those which were only suspicious of resulting from bacterial infections, are considered, the percentage increases to 10.6 and 42 per cent respectively.

Of the 200 cases 119 were operated upon and 81 treated with radium. Of the 119 operated cases 91 were those with a favorable Ruge-Philipp test resulting in 10.9 per cent inflammatory complications and 28 those with unfavorable Ruge-Philipp test resulting in 35.7 per cent inflammatory complications. Of the 81 cases treated with radium, 59 cases were those with a favorable Ruge-Philipp test with 6.7 per cent inflammatory complications and 22 cases those with unfavorable Ruge-Philipp test with 27 per cent inflammatory complications.

Additional tests were made also in order to determine the part of the streptococci in the virulence of the bacterial flora. Of 100 cases of streptococci with a favorable virulence test, 69 were streptococci without hemolysis, 15 with hemolysis and obligate anaerobic growth and 16 hemolytic streptococci. Of 22 cases of streptococci with unfavorable virulence test, 10 were streptococci without hemolysis, 3 with hemolysis and obligate anaerobic growth and 9 hemolytic streptococci.

The conclusion is reached that the Ruge-Philipp test is of certain value in determining the virulence of the infection in collum carcinomas. The majority of the virulent streptococci are hemolytic although the hemolytic property does not closely follow the virulence of the bacteria.—*T. Leucutia.*

Gabriel, Gerhard. Physical and biological investigations on the borderline rays. *Deutsche med. Wchnschr.*, Feb. 22, 1929, lv, 315–316.

Bucky, shortly following the description in 1925 of the borderline rays, assumed that these very soft roentgen rays (between 6 and 12 kv.) do not penetrate beyond the epidermis and that consequently the erythema must appear on a reflectoric base due to stimulation of the nerve endings of the epidermis. Likewise the drop in the leucocytes which invariably follows the application of borderline rays was considered as a reflectoric effect of these rays. This view was further substantiated by the excellent results obtained in the diseases which are known to be influenced through the vegetative system of the skin such as duodenal ulcer, asthma, polycythemia, etc.

The author already in 1926 refuted the veracity of the above hypothesis and by means of experiments of his own has proven that the effect of the borderline rays is deeper than the epidermis of the skin. Continuing the investigations since that time (especially on rabbits) he now is convinced that the reactions brought about by the borderline rays are identical to the roentgen-ray reactions and that they follow the same physical laws. According to this, an exact dosage of the borderline rays (with Rajewsky's small ionization chamber) in R units is possible. Moreover, measurements performed in the subcutis of the rabbit ear proved that in case of an ulcerative dose 55 per cent of the initial radiation reaches the subcutaneous tissues. Measurements underneath the skin and other tissues showed that with 9 kv., 23 per cent of the radiation reaches the deeper tissues. The more recently applied capillary microscopic investigations led to similar results.

The conclusion is reached that borderline rays do not occupy a special position but that they follow the biological and physical laws of roentgen radiations.—*T. Leucutia.*

Gunsett, A., and Spack, Ch. Ionometric dosimetry at the Anticancer Center in Strasbourg. *J. de radiol. et d'électrol.*, March, 1929, xiii, 199–208.

The first part of the article deals with practical measurements of roentgen radiation. The Solomon ionometer with small ionization chamber is used for the determination of the dose, while the intensity of the radiation is controlled by the Dauvillier ionometer. This latter

consists of a small ionization chamber filled with xenon, the ionization of which is measured with the aid of a needle galvanometer. In order to increase the sensitivity of the apparatus the authors have lately replaced the needle galvanometer with a mirror galvanometer.

The dose which was formerly expressed in French R is—since the introduction of the international r—computed also in electrostatic units. The Küstner ionometer is used for the standardization in electrostatic units. The advantage of the application of both units simultaneously lies especially in the fact that comparisons with former irradiations are possible.

In the second part of the article the investigations dealing with the dependence of the biological action on the quality of the roentgen rays are presented.

In a first series of experiments the human skin erythema is used for the biological measurements. As is well known there is a great controversy as to whether or not equal quantities of roentgen rays of different wave length (measured in r units) produce equal biological reactions as expressed by the erythema of the skin. Numerous investigators such as Glasser, Meyer, Wintz and Rump, Sievert, and Klein and Gaertner, maintain that with the same number of r the erythema is greater, the longer the wave length of the rays applied, while Jona, Schreus and Schoenholz maintain the opposite. Holthusen, Dotermann and Jacobi, and Hess, are of the opinion that for the quality of roentgen rays from 0.06 to 1.32 Cu there is no difference in the number of r necessary to produce the same erythema, assuming that small fields of 3 cm. are used so as to eliminate the effect of scattering.

The authors repeated the investigations of Holthusen by using the Küstner ionometer and by reproducing the same experimental conditions. The qualities of the roentgen rays investigated were 120 kv. (without filter; with 1 mm. Al and 5 mm. Al filters), and 200 kv. (with 0.5 mm. Cu; 1 mm. Cu; 1.5 mm. Cu and 2 mm. Cu filters); Gaiffe, Gallot and Pilon apparatus, 3 ma., 35 cm. skin target distance and 3 by 3 cm. fields. As in Holthusen's experiments the Küstner ionometer was placed in a position so as to enable the application of the dose on the patient without disturbing the instrument and the dose was measured both preliminary to and following the completion of the treatment. However, while Holthusen used the frank erythema as unit of measurement the authors applied the threshold erythema. It was found that by using very small fields (so as to eliminate the scattering) the threshold erythema which is characterized by a very slight but net demarcation of the irradiated area from the normal skin, appears for all qualities of roentgen rays with 420 r, except for the roentgen rays of very long wave length (120 kv. without filter) where it appears with 160 r and the roentgen rays of very short wave length where it appears with 500 r. If the fields are large, as for example, 11 by 11 cm., a perceptible difference is noticed for the 420 r in the roentgen rays with 0.5 and 2 mm. Cu. The difference is still larger with 550 r, and with 593 r it is enormous. This indicates that the number of r necessary to produce an erythema in case of large fields is smaller the longer the wave length.

In a second series of experiments with Mlle Ancel, the biological action of the roentgen rays was determined on germinating seeds of Spanish lentils. The procedure was as follows: The seeds were first placed between layers of wet cotton for a period of forty-eight hours, then the seedlings with roots 10 mm. long were picked out and irradiated in lots of 35. Following the irradiation the experimental seedlings were placed on the surface of water and fourteen days later examined with regard to the length of the roots and stem. The figures obtained were added and divided with the number of the individual lentils. The same procedure was used for the controls. The quality of roentgen rays used was 200 kv., 2 mm. Cu and 2 mm. Al; 200 kv., 0.5 mm. Cu and 1 mm. Al and 120 kv. without filter; Gaiffe, Gallot and Pilon continuous current apparatus, oil immersed tube, 5 ma., 21 cm. distance. The seeds were placed during the irradiation in glass cups of 6 cm. diameter spread on wet cotton of 3 mm. thickness (the cups being placed on a stool with a top 2 cm. thick). In one series of experiments small doses of 160 r, in a second series large doses of 280 and 320 r were used. In case of small doses the roots of the lentils showed a difference of 4.3 per cent between the rays of 2 mm. Cu and 0.5 mm. Cu and of 13.3 per cent between the rays of 2 mm. Cu and 120 kv. without filter. For the large doses the difference between 2 mm. Cu and 0.5 mm. Cu was 24.4 per cent and between 2 mm. Cu and 120 kv. without filter, 36.9 per cent. The same observations were made for the stems, the difference in the small doses being 2.5 and 10.6 per cent respectively, and for the large doses 21.3 and 27 per cent respectively. These figures appear still larger if one takes into consideration that due to the additional scattered radiation an initial dose which is 5.5 to 7 per cent larger is used with the harder rays.

The conclusion is reached that the number of r necessary to produce the same biological

effect on the germinating seeds of lentils depends on the wave length of the roentgen rays applied. These results confirm the findings of Jüngling, Glocker and Hayer.—*T. Leucutia.*

Hill, Eben C. A radiopaque bismuth suspension for anatomical, histological and pathological research. *Johns Hopkins Hosp. Bull.*, April, 1929, xliv, 248–265.

In a series of experiments on cadavers, the author investigated the qualifications of different opaque media for the injection of the vascular system. It was found that bismuth oxychloride (Merck's "cosmetic bismuth" and Mallinckrodt's "finely divided bismuth oxychloride") was the most suitable contrast medium if suspended in a solution of gum acacia (a suspension of 20 per cent bismuth oxychloride in a 11 per cent solution of acacia, on an average). The acacia serves as an agent to aggregate the finely divided particles of bismuth and by employing cloth filters of various meshes for semifiltration, unit masses of any desired size may be obtained. This is important since experience has shown that the percentages of both the bismuth and the acacia must be varied for different tissues.

The injection may be performed either previous to or following the appearance of rigor mortis. During rigor mortis itself a complete injection is not usually possible. Some beautiful roentgenograms are presented illustrating the results of the injection. The tissues may also be studied microscopically either as clear specimens or by different methods of staining.—*T. Leucutia.*

Magath, M. A. On the question of reaction imbalance in roentgen irradiated tissues. *Strablentberapie*, 1929, xxxii, 534–549.

The author determined the disturbance in the acid-alkaline balance of the tissues following roentgen irradiation. Different methods were used for this purpose such as the electrometric determination by means of the hydrogen and chinhydron electrodes, the colorimetric method in vitro according to Cullen, and the vital staining according to Rous (with Clark's indicator).

The following are the results of the experimentation. Shortly (five minutes to one hour) following intensive roentgen irradiation an intravital disturbance of the acid balance of the tissues is observed in chicken embryos. There is increased acidity which can be demonstrated on the macerated tissue of the whole embryo.

In analyzing the balance disturbance for different parts of the embryo an increased acidity was regularly found in the superficial soft tissues (skin and mesenchyme, and especially muscle), while the liver and brain showed no reaction disturbance.

Likewise no noticeable reaction imbalance was observed in the irradiated tissues of mouse carcinoma (5 to 6 S.U.D. in vivo) and mouse liver. In this respect, malignant tumors proved no different from the normal parenchymatous tissues with active metabolism.

The vital staining with brom-thymol blue (subcutaneous and intracutaneous injections) resulted in a quicker disappearance of the staining in the irradiated regions, a fact which cannot be sufficiently explained by the reaction imbalance.—*T. Leucutia.*

Mason, Michael. L. Carcinoma of the hand. *Arch. Surg.*, May, 1929, xviii, 2107–2158.

This paper is based on: (1) Twenty-five cases of carcinoma, precarcinomatous ulcers and roentgen dermatitis. Eight of the 25 were cases of roentgen dermatitis with carcinoma, two were roentgen dermatitis without carcinoma, one was a radium wart of the thumb, 7 were carcinoma following trauma or scarring of the hand, one was a precarcinomatous ulcer from an alkali burn, one, a carcinoma following a wart, 2 were carcinomas developing from previously unchanged skin, and 3 were carcinomas in which the history was faulty and no conclusion as to etiology could be made. (2) The collection from the literature of 241 reported cases of carcinoma of the hand, exclusive of roentgen and radium carcinoma and dermatitis. (3) The study of the literature on roentgen and radium dermatitis.

Volkmann's classification is used in this discussion: (A) those carcinomas arising as the result of some trauma or irritation, or on the basis of a scar; (B) those arising from a previously present growth, such as a wart, divided into (B1) those in which the growth had been congenital, and (B2) those in which the growth, usually a wart has appeared later in life: (C) carcinoma arising de novo from previously unchanged skin, and (D) a group which is made up of all those cases in which the data are too meager to allow classification. Case histories of all these types of cases are given in great detail.

The pathology and pathogenesis of roentgen and radium dermatitis and carcinoma, and its prognosis are fully discussed. Excellent photomicrographs of the histological sections are shown. The entire series of cases is fully analyzed and commented upon. Duration of life, etiology, age and sex incidence, symptoms and clinical course, and treatment are described for each group of cases.

This is a very long paper which cannot be

fully summarized in a short abstract. It is well tabulated containing eight tables of the cases of the author's series, and of the collected cases. As a reference work it is especially valuable.

Mason states in his summary that diagnosis of carcinoma of the hand may be difficult even with microscopic section, and the clinical course and history are of value in reaching a decision. The prognosis is in general favorable for the cases in Groups A and C, fair in B2 and very poor in Group B1. In the case of roentgen carcinoma the prognosis is good, providing all involved tissue, whether carcinomatous or not, is removed. Conservative measures are usually successful if promptly carried out, and radical surgical treatment is needed only in neglected cases, with the exception of cases in Group B1 in which radical surgical intervention is advisable from the start. In the case of carcinoma arising from roentgen dermatitis, in which multiple areas of keratosis are present, it is imperative that all keratotic spots be excised, regardless of their extent.—*R. S. Bromer.*

NAUJOKS, H. Fertility and offspring of former female roentgen assistants. *Strahlentherapie*, June 5, 1929, xxxii, 613–639.

After a brief historical review of the injuries to the reproductive glands in roentgen assistants of both sexes (in which the statistical results of Nürnberger and Belot are especially emphasized), the author presents his own investigations in 91 women, all former roentgen assistants and their 125 children. Of the 91 cases 56 were personally examined by the author, while 35 were collected from other institutions. Of his 56 own cases, all of whom married during a period of from a few weeks to three years following the cessation of their occupation, 13, that is almost one-fourth, had no children (2 facultative sterility, 3 not sufficiently long married, 6 true sterility from 4½ to 7½ years' duration, one secondary sterility with one abortion, and one, habitual abortion). Of the 35 cases indirectly collected, 9 had no children, thus making a total of 22 out of 91.

The number of abortions in the 45 mothers of the first group (2 cases having been classified also under sterility) was 22 (in 19 individuals) which as compared to the number of children normally born (86) represents 25 per cent. The number of abortions in the second group is not known.

Of the 125 children born, 86 were those of 43 mothers of the first group observed by the author and the rest of 26 mothers indirectly collected.

Nine children have shown more or less pronounced developmental disturbances: 1, hydrocephalus, clubfoot, imbecility; 1, large abdominal hernia; 1, anencephalus, meningocele; 1, congenital heart disease; 1, navel hernia, general debility; 1, Little's disease; 1, hypernervousness; 1, myopia and general debility and 1, labile nervous system with encephalitis lethargica. If only the 5 cases of true developmental disturbances are included the percentage is 4.

The conclusion is reached that although there is a large percentage of sterility (25 per cent) observed in former female roentgen assistants the number of abortions represents the ratio observed (under the present social conditions) in normal individuals. The percentage of defective children (4 per cent) is somewhat high. No attempt is made to attribute the above figures (in sterility and deficient children) to the direct effect of the roentgen rays, although such a procedure might be justified a priori.—*T. Leucutia.*

PACKARD, CHARLES. The relation of wave length to the death rate of *Drosophila* eggs. *J. Cancer Research*, March, 1929, xiii, 87–96.

Since *Drosophila* eggs are exceedingly sensitive to radiation they may be used as a good object for biological measurements. A dose as small as 50 R kills a few of the individuals in any sample, while 180 R kills half the population (doses without scattering effect being used).

A series of experiments were undertaken by the author with rays of different wave length (0.02 Å, gamma rays; 0.015 Å, 150 kv.; 0.22 Å, 90 kv., 0.68 Å, 30 kv., and 1.70 Å, 10 kv.) and the conclusion was reached that the course of the survival curve of *Drosophila* eggs is the same. This allows a direct comparison between the intensities of these beams.—*T. Leucutia.*

RATTI, ARDUINO. The fundamental principles and technique of stereoroentgenography. *Radiol. med.*, March, 1929, xvi, 270–298.

The general principles of stereoscopic vision and their application to roentgen stereoscopy are discussed. The linear perspective, the aërial perspective, the shadow effect and the difference in the specific perspective of the images of the right and left eye are analyzed in detail and their value in stereophotography and stereoroentgenography compared.

In describing the different methods used for the making of stereoroentgenograms special attention is paid to the formula of Marie and Ribaut as well as to the procedure of the American authors, Kurtz and Bridge.

In reviewing the different apparatus used

for reading stereoscopic films the author makes mention of his own stereoscope, which is a modification of the Alberti hand stereoscope (30 × 8 × 10 cm. dimensions), and which has the advantage that the two lateral mirrors are mobile so that images of various distances (from 40 to 150 cm.) can be viewed. A detailed bibliography is appended.—*T. Leucutia.*

Ratti, Arduino. Observations on roentgen-ray measurements. *Radiol. med.*, June, 1929, xvi, 561–574.

The author discusses the most common practical errors of measurement of the quality and quantity of roentgen radiations.

In the determination of the quality of radiation, the following errors are made: (1) In spectrography. This method since it is of purely scientific interest is not discussed. (2) In measuring of the secondary tension. Different results are obtained with constant tension currents and pulsating currents, and with different type of tubes (this applying especially to superficial radiation). The author compared the quality of the roentgen rays obtained by an "Itala" and an A.E.G. tube as measured by the spark gap and the aluminum half-value layer, and found (for 70 to 110 kv. without filter and with 1 mm. Al) a very marked difference in the quality of the rays. (3) In absorption measurements. This method, apart from being of limited accuracy, gives only the average penetration of the roentgen-ray beam.

The errors made in the quantitative measurements may be due: (1) To faulty electrical conditions (insufficient insulation of the line and stands; electric corona due to angulations and unevenness of the line; humidity and dust; regulation of the tension by means of the auto transformer and resistance, etc.). (2) To faulty dosimetric conditions (insufficient electrical insulation, lack of complete saturation, inadequate protection of the electrometric system, poor construction of the apparatus, etc.). (3) To inadequate dosimetric procedures, this being especially true when using small ionization chambers. The value of the dose as measured "in air" and on the surface of the body with back-scattering is discussed in detail and the factors leading to errors in back-scattering are given.—*T. Leucutia.*

Roffo, A. H., and Correa, L. M. The destruction of cholesterin by means of roentgen rays in vitro. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, xxxix, 882–889.

Four years ago Roffo published the results of his experiments on the action of roentgen rays on cholesterin. The experiments were performed with the blood of about 50 patients, and in each instance a decrease in the cholesterin amount of the blood following irradiation was found. Since that time numerous other publications have appeared dealing with the roentgen-ray effect on the cholesterin both in vivo and in vitro. While there was an almost unanimous agreement that there is destruction of the cholesterin due to irradiation in vivo, the experiments in vitro did not always prove so conclusive.

The authors themselves, by repeatedly irradiating cholesterin in choloroform solution (0.02 per cent being considered as standard) with roentgen rays (200 kv., 4 ma., 17 cm. skin target distance, without filter), and by using the Liebermann test, found that there was a destructive effect of the roentgen rays on the cholesterin in vitro. Later, however, when the experiments were repeated by other investigators with other solvents it was found that although there was evidence of a destruction of cholesterin in chloroform, bromoform and carbon tetrachloride solutions, there was no evidence of destruction when benzine, carbon disulphide and benzomonochloride were used as solvents.

More recently Schreuss and Schulze, by taking a 0.2 per cent cholesterin solution in chloroform (that is, ten times more concentrated than the standard solution), denied the destructive effect of the roentgen rays on the cholesterin even in chloroform. The authors in repeating the experiments of Schreuss and Schulze with the same concentration of cholesterin and by using the same solutions as reagents were unable to verify those findings. Moreover they found that there is, one may say, a mathematic accuracy between the ratio of cholesterin destruction and the dose of the roentgen rays applied. The failure of Schreuss et al to arrive at the same results must be due to the fact that they did not use sufficiently large doses of roentgen rays.

It remains for the future to determine the exact nature of the substances resulting from the destructive action of the roentgen rays and thus to establish a physiological measure of the effect of the irradiation on the cholesterin.—*T. Leucutia.*

Rohrschneider, Wilhelm. Experimental investigations on the changes of normal eye tissues following roentgen irradiation. 1. Purpose of experiments. Definition of the roentgen radiation applied. *Arch. f. Opbth.*, Feb. 4, 1929, cxxi, 526–536.

After a short review of the experiments

dealing with the effect of roentgen rays on normal eyes, the author presents his own investigations on the relative roentgen sensitivity of the different eye tissues and on the doses which are necessary to produce various degrees of injury to these tissues. Since the experiments were carried out in rabbits, first the epilation dose of the rabbit and its relation to the human erythema dose was determined. Roentgen rays of two different wave lengths were used for this purpose. The following data were obtained: Apparatus, Veifa Neo-Intensiv, 188 kv., 4 ma., 23 cm. skin target distance, lead glass tube of 4 cm. diameter. (1) *3 mm. Al filter;* 0.4 mm. Cu half-value layer, primary radiation of 100 R in 49 sec.; 1 S.U.D. in 4¾, minutes corresponding to a primary radiation of 567 R; epilation dose of rabbit in 8 min. equaling 170 per cent human S.U.D. and corresponding to a primary radiation of 980 R. (2) *0.5 mm. Cu plus 3 mm. Al. filter;* 1.0 mm. Cu half-value layer, primary radiation 100 R in 122 sec.; 1 S.U.D. in 10 min. corresponding to a primary radiation of 492 R in 122 sec.; 1 S.U.D. in 10 min. corresponding to a primary radiation of 492 R; epilation dose of rabbit in 18 min. equaling 180 per cent human S.U.D., and corresponding to a primary radiation of 890 R.—*T. Leucutia.*

THIBAUDEAU, A. A. Suggestive findings revealed at autopsy in patients treated by radiation. *J. Cancer Research,* March, 1929, xiii, 66–72.

Three hundred autopsies performed between 1925 and 1926 at the New York State Institute for the Study of Malignant Disease were analyzed with regard to the occurrence of pulmonary embolus, hydronephrosis and intraperitoneal infections as a complicating factor in different types of malignancies. Eight cases of pulmonary embolus (7 cases in malignancies, 4 of which had been irradiated and 3 without treatment), 15 cases of hydronephrosis (all, with the exception of one, occurring in pelvic tumors) and 17 cases of local and general infection of the abdominal cavity (chiefly through perforation of carcinomas of different abdominal organs) were found. The conclusion is reached that radiation therapy cannot be said to have any causal relation to any of the above-mentioned complications.—*T. Leucutia.*

UNTERBERGER, F. Roentgen injury of the fetus through repeated roentgenoscopy during pregnancy. *Zentralbl. f. Gynäk.* Jan. 5, 1929, liii, 44–46.

The author describes a case of pregnancy which, following repeated roentgenoscopies came to interruption four weeks before term. The woman had two normal pregnancies, and since the third pregnancy is the only one which came to interruption, it is assumed that this was the result of the injuries produced by the repeated roentgenologic examinations. An autopsy of the fetus revealed evidence of developmental disturbances.—*T. Leucutia.*

VISCHIA, QUINTINO. Studies and contributions to castration by irradiation of the hypophysis. IV. Experimental research (thyroid, pancreas, adrenal). *Radiol. med.,* March, 1929, xvi, 249–270.

After a very detailed review of the literature dealing with the physiopathology and the relation of the pituitary gland to other endocrine glands, the author presents the results of his own investigations on the effect of the irradiated pituitary on the thyroid, pancreas and adrenals.

Young dogs which had already reached sexual maturity were used for the experimentation. According to the amount of radiation given the animals were divided into two groups: (1) those treated with 120 kv., 3 ma., 0.5 mm. Cu, 30 cm. skin target distance, 1 S.U.D. (20 to 40 min.), Stabilivolt apparatus, and (2) those treated with 150 to 180 kv., 3 to 4 ma., 0.5 mm. Cu, 30 cm. skin target distance, 1 S.U.D. (the doses having been administered in both instances through two temporal fields).

Three months following the irradiation the animals were killed (by chloroform), and the thyroid, pancreas and adrenals were histologically examined (staining with hematoxylin-eosin and van Gieson).

It was found that except for a slight hyperemia of the pancreas and adrenals, no noteworthy histological changes occurred in any of the glands examined, this indicating that the irradiation of the pituitary is entirely harmless.

On the other hand, since irradiation of the pituitary has proven of considerable clinical value in the treatment of uterine dysfunctions (especially metrorrhagia) one may surmise that the effect is through internal secretion rather than through histological alterations of the genital organs. It must be admitted nevertheless that all opinions attempting to explain the action of the irradiated pituitary on the utero-ovarian functional disturbances are purely hypothetical, no definite proof having as yet been brought by any of the investigators. A detailed bibliography of 80 references is appended.—*T. Leucutia.*